DOCUMENT RESUME

ED 053 857 RC 005 550

AUTHOR	Madden J. Patrick; Yoder, Marion D.
TITLE	Program Evaluation: Food Stamps and Commodity Distribution in Rural Areas of Central Pennsylvania.
INSTITUTION	Pennsylvania State Univ., University Park.
SPONS AGENCY	Department of Agriculture, Washington, D.C.
PUB DATE	2 Aug 71
NOTE	166p.
EDRS PRICE	EDRS Price MF-$0.65 HC-$6.58
DESCRIPTORS	Dietetics, Eating Habits, *Economic Disadvantagement, Economic Research, *Federal Programs, Low Income Groups, Models, *Nutrition, Nutrition Instruction, Research Needs, *Rural Population, *Statistical Analysis, Tables (Data)
IDENTIFIERS	Pennsylvania

ABSTRACT

Since one primary goal of the Commodity Distribution (CD) Program and the Food Stamp (FS) Program is to improve diets of low-income families, this 1969-70 study focused on whether the adequacy of a low-income family's dietary intake was improved by their participation in a food-assistance program. As stated, the adequacy of a family's dietary intake is influenced by a wide range of factors, which may be classified under 2 major categories: (1) the family's food-purchasing power and (2) the efficiency with which the food resources are utilized. Thus, data on these factors were obtained from more than 1000 repeated interviews of rural homemakers and were subjected to multivariate analysis. Some of the main conclusions were that low-income families were most deficient in vitamin A and calcium, and were least deficient in phosphorus and protein; CD families had no better diets than non-CD families; the FS provided some improvement in diets of families experiencing temporary fund shortages (e.g., more than 2 weeks since payday); when families had received some income within the past 2 weeks, the impact of FS was not significant; families receiving income at least once every 2 weeks had significantly more adequate diets than those who were similar in other respects but received income less often; FS families substituted a large proportion of their increase in food-purchasing power for expenditures other than food; and families did not use their increased purchasing power to obtain foods that would provide the nutrients most deficient in the family's diet. (JB)

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PROGRAM EVALUATION: FOOD STAMPS AND COMMODITY DISTRIBUTION IN RURAL AREAS OF CENTRAL PENNSYLVANIA

by

J. Patrick Madden and Marion D. Yoder

Department of Agricultural Economics and Rural Sociology
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August 2, 1971

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PREFACE

This report is the culmination of more than two years of research. The surveys and early analysis were sponsored by the Department of Agricultural Economics and Rural Sociology and the Agricultural Experiment Station (Project 1744, "Low Income People of Rural Pennsylvania," and NE-68, "Paths Out of Poverty"). Funds to support and expedite the final analysis were recently obtained from Food and Nutrition Service, USDA.

Helpful comments and suggestions for improving earlier drafts of this report were obtained from many reviewers, especially Helen Guthrie, George Brandow, Bob Herrmann, Don Epp, Steve Hiemstra and Keith Bryant. The authors accept full responsibility for any deficiencies that may remain in this report.

CONCLUSIONS

One of the primary goals of the Commodity Distribution (CD) Program and the Food Stamp (FS) Program is to improve the diets of low-income families. Thus, in this study the focus has been on the question of whether the adequacy of a low-income family's dietary intake is improved by their participation in one of the family food assistance programs.

The adequacy of a family's dietary intake at any point in time may be influenced by a wide range of factors, both within and outside the family. Two major categories of relevant factors are (1) the family's food purchasing power, or more generally the availability of food resources, and (2) the efficiency with which the food resources are utilized, in terms of the types of food obtained and the manner in which it is prepared and cooked for the family. While the CD and FS programs are designed to increase the family's food purchasing power, factors reducing nutritional efficiency can have an off-setting effect.

The data on which this report is based were obtained from repeated interviews of a panel of homemakers during 1969 and 1970 in Bedford and Huntingdon Counties, located in rural Pennsylvania. The sample included both program participants and nonparticipants. The main conclusions are as follows:

1. As in other studies of this type, the low-income families were found to be most deficient in Vitamin A and calcium, and least deficient in phosphorus and protein.
2. CD families were found to have no better diets than non-CD families that were similar in other respects.
3. Food Stamps provided some improvement in the diets of families experiencing temporary shortages of funds, e.g. more than two weeks since pay day.

4. Under more favorable conditions, when families had received some income recently (within the past two weeks) the impact of FS was not significant.
5. Families receiving income at least once every two weeks had significantly more adequate diets than those who were similar in other respects but received income less often.
6. The FS bonus (difference between purchase price and redemption value of the coupons) varies widely by family size and income. Recent (1970) revisions in the FS cost schedule did not change the amount of the bonus for some families. But for families interviewed in this study, on the average, the revision led to about twice as large a bonus. However, the amount of a participating family's FS bonus was not significantly related to their dietary adequacy.
7. Families achieve a greater nutritional efficiency (more nutritional value per dollar of food cost) when less resources are available. The study results suggest this is true for both cash and food coupons.
8. Nutritional efficiency tends to decline as the family approaches or exceeds dietary sufficiency. Families with the most adequate dietary intake were generally the least efficient in the utilization of food acquisition resources. This presumably results from the tendency to emphasize convenience and taste satisfaction rather than nutritional value, especially as the level of food consumption is extended above the barest subsistence level.

9. The effect of FS participation on the dietary adequacy of each of the 10 nutrients was also examined. When less than two weeks had elapsed since pay day, no significant improvements were predicted in any of the 10 nutrients. However, when more than two weeks had elapsed since pay day, FS families who had recently purchased food coupons had significantly higher intake of some nutrients. In 3 of the 4 FS surveys conducted, the iron and thiamin intake of recent FS recipients was predicted to be much higher than that of other low-income families.

10. Similar improvements were predicted, though less consistently, in the case of protein, phosphorus, riboflavin, and niacin. Typically the increases in these four nutrients were beyond an already adequate level, so that no real improvement in dietary adequacy was effected.

11. Food expenditures of the families surveyed here usually did not increase significantly with the introduction of FS.

12. Based on the evidence that the dietary impact of FS is significant only under less favorable conditions (such as a shortage of cash) and that food expenditure was usually not increased significantly, it is apparent that (a) the FS families are substituting a large proportion of their increase in food purchasing power for expenditures other than food, and (b) the families are typically not using their increased purchasing power to obtain foods that would provide the nutrients most deficient in the family's diet.

PART I. SUMMARY AND RECOMMENDATIONS

A. PURPOSE AND PERSPECTIVE

Society has devised a number of programs to cope with various aspects or dimensions of poverty. Programs in aid to the poor are broadly categorized as "in-cash" income transfers (for example, AFDC or Public Assistance), or "in-kind" income transfers (such as Medicaid or Food Stamps). It seems self-evident that the poor would prefer to be considered as consumers, rather than dependent clients who must be told how to spend the aid society offers. Yet society prefers to bypass consumer sovereignty in the case of certain goods and services, through use of various "income-in-kind" programs. The implicit assumption seems to be that people will achieve more adequate medical care through use of Medicaid than they would with the same amount of money given as a cash grant, for example. Similarly, the continued existence of the Food Stamps Program seems predicated on the premise that it will enable the poor to buy more and better food, prepare better meals, and achieve better nutritional status and health, and hence greater productivity in jobs, school or other occupations.

The primary purpose of the study reported here was to question the key aspect of this premise: is the adequacy of a poor family's dietary intake enhanced by their participation in family food aid programs? The study was designed to determine changes in adequacy of the family's diet as the family changed program participation status. It was hypothesized that families participating in these programs would have better diets than those not participating, other things being equal. Furthermore, it was hypothesized that families who drop out of the program would have less adequate diets than those who remained in the programs. Three family food programs were involved in this analysis. First is the Commodity Distribution (CD)

Program; second is the 1969 Food Stamp Program (FS_1); and a revised Food Stamp Program (FS_2), which included modifications adopted early in 1970. [26] It was hypothesized that families who remained in the food aid programs would have improved diets, as they moved from CD to FS_1 to FS_2. The strategy of this study was to obtain and analyze data from a sample of low income families at crucial points in time, just before and after changes in availability of these food assistance programs. A total of 5 surveys were conducted; 3 in Bedford County and 2 in Huntingdon County. More than 1,100 interviews were completed, and more than 1,000 of these were sufficiently complete to allow their inclusion in multivariate analysis.

Through this analysis, it was hoped that additional light would be shed on the important policy questions with regard to the dietary effectiveness of the "income-in-kind" food aid programs. Proponents argue that this type of program is more effective in improving the diets of the target population than is true of cash income transfer programs. The analysis done in this study provides additional information regarding that question, but it does not answer the entire question. If it is found, for example, that a certain food aid program has a highly beneficial effect on the diets of the poor, the question still remains whether cash income transfers of the same magnitude would bring about similar improvements. On the other hand, if little or no improvement in the diets of the poor can be brought about by the food aid programs, they must be justified on other grounds, such as their income transfer effect. In that case a serious question would arise as to whether the programs should continue in their present form.

The study reported here is based entirely on data obtained from the five surveys conducted in rural areas in Central Pennsylvania (Bedford and Huntingdon Counties). In terms of the overall national policy questions, it is not possible to draw definitive answers from a study as limited in scope as the present one. Additional analysis is now underway, using data from rural areas in two additional states (North Carolina and Iowa). These data were collected as part of the third quarterly interview of families participating in the rural negative income tax experiment, being conducted by the Institute for Poverty Research at the University of Wisconsin. Data from these states will allow analysis of possible tradeoffs between the negative income tax and food aid programs. When the results are completed from all of these locations, it is hoped that a consistent pattern of policy inferences may be drawn. As soon as the data from the other states are analyzed, a supplementary report will be prepared. Additional studies will be needed in a number of urban locations, as well as a wider range of rural situations in different parts of the nation.

B. EFFECTS OF FOOD PROGRAMS

Primary attention is given to estimation of the effects of the programs on the dietary adequacy of the participants, since improved nutrition is currently the primary purpose of the programs. However, other effects are also considered, including changes in participation, cost-effectiveness, nutritional efficiency, and effects on food purchase.

1. Dietary Adequacy--Differences Between Participants and Nonparticipants

The primary focus of this analysis is on the effects of the various food aid programs (CD, FS_1, and FS_2). The effects of these programs are interpreted in the context of nonparticipant comparison groups in the same county and time period, so that adjustment for seasonal changes would not be necessary.[1] The effect of food programs was isolated and tested by holding a number of other variables constant in multiple regression equations. Indexes were devised for purposes of this analysis, to reflect differences in the dietary adequacy of various subgroups of the sample--e.g. participants versus nonparticipants. Comparisons were made for 10 individual nutrients.[2] For this purpose a ratio of family intake to need was computed to represent the adequacy of intake for each nutrient. An overall index of dietary adequacy (the MAR or Mean Adequacy Ratio) was also computed, as the average of the 10 nutrient ratios, each cut off at an upper value of 100 percent, representing an intake equal to or exceeding the Recommended Dietary Allowances (RDA).[3] A family reporting an intake of 100 percent or more of the RDA levels of each of the 10 nutrients would have an MAR of 100, for example.

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[1] This does not preclude the possibility that the dietary benefits derived from the program may vary from one season to another during the year. Additional research is needed, including observations from different times of the year and various locations, to obtain a valid estimate of seasonal effects.

[2] Other nutrients were ignored because data for necessary computations were not available. The following 10 nutrients were used: energy, protein, calcium, phosphorous, iron, Vitamin A, thiamin, riboflavin, niacin and Vitamin C.

[3] See the attached technical report for a detailed discussion of the MAR index.

The results were quite different for the various programs and locations. Tests of statistical significance were computed for comparison of program participants versus a comparison group of nonparticipating families.

It should be understood, however, that statistical significance and economic or practical significance are not always the same. A result can be statistically non-significant, and this fact can have considerable practical importance. Negative results can be just as relevant as positive findings. For example, if a factor that was thought to influence strongly the dietary adequacy is found to have a very weak and statistically non-significant effect, this result can have important policy implications. Conversely, when a result is "statistically significant," say at the 5 percent level of probability, this means there is very little chance that this result is due to random variation (a 1 in 20 chance). Even when a result is statistically significant, the actual magnitude may be large or small, depending on the variance of the estimate. If the variance is low, as is the case in several instances reported here, then a very small difference can be statistically significant. For purposes of program evaluation, statistical significance should be used only as a guide to the reliability of the estimates. Beyond this, the actual magnitudes should be scrutinized carefully, to determine whether the differences have any practical importance.

CD Versus Non-CD in Bedford County

The CD program, as it was operating in Bedford County in June 1969, had no significant impact on the overall dietary adequacy (MAR) of the participating families. It was hypothesized that a significantly beneficial effect would be observed, particularly during the first two weeks after receiving the CD foods. Similarly, it was hypothesized that when more than two weeks had elapsed since pay day, these effects would be greater than during the early part of the pay month. Neither of these hypotheses was supported by the evidence found in this study. The program seemed to have no significant effect, even beyond two weeks since pay, and when the families had recently (within two weeks) received their commodities.

CD users were predicted to have 18 percentage points more adequate intake of protein (150 versus 133 percent of RDA) than did non-CD families, other things being equal. However, this result was not highly significant; differences this large have about a 1 in 10 probability of occurring by chance. Furthermore, the nutritional, as opposed to the statistical, significance of raising intake further above an already more-than-adequate level (from 133 to 150 percent of RDA in this case) may be open to question.

Conversely, the predicted calcium intake of CD users was significantly lower than the comparison group--23 percentage points (66 versus 89 percent of RDA). The two groups had similar predicted intakes of the other eight nutrients, and their indexes of overall dietary adequacy were not significantly different.

Several reasons are offered why the CD program made no significant impact. Other studies have shown that families receiving CD foods tend to substitute free foods for those formerly purchased, thus freeing funds for other expenditures. [12] The full 22 item package which the USDA offered during 1969 would provide more than the "recommended adult requirements" for 6 of 8 nutrients. [30, p. 22] However, the national average number of items distributed to CD recipients was about 18; only 13 items were distributed in Bedford County during the months of this survey. A family of four in Bedford County with children ages 10 and 12, would have acquired the following percentages of recommended dietary allowances, assuming the family ate only the CD foods and there was no waste:

Nutrient:	Percent of RDA from 13 CD foods (Bedford County, 1969)
Energy	43
Protein	53
Calcium	33
Phosphorous	50
Iron	49
Vitamin A	32
Thiamin	58
Riboflavin	37
Niacin	38
Vitamin C	44

As a matter of fact, many of the respondents said they did not use some foods--particularly the scrambled egg mix. Therefore, it is not surprising that little impact was observed from the CD program.

FS Versus Non-FS in Bedford and Huntingdon Counties

In each of the surveys conducted, somewhat better diets were found among FS than non-FS families, under certain circumstances, as follows:

1. The beneficial effect of Food Stamps was apparent only within the first two weeks since the family purchased the stamps. Very little benefit was found more than two weeks since purchase. Apparently a disproportionate share of food stamps are used up soon after they are purchased.
2. Similarly, the nutritional benefit due to FS was perceptible only when some time had elapsed (over two weeks) since the family had received its major income for the month. These differences in dietary adequacy were statistically significant (at the 5 percent level of probability) in Bedford County, indicating that there is very little likelihood that the results are due to random variation. In Huntingdon County the improvement due to FS was less significant. Among those families interviewed within two weeks since

receiving their major income, no significant difference was apparent between FS participants and nonparticipants.

3. The dietary difference between FS participants and nonparticipants was expected to be somewhat greater with FS_2 than FS_1. However, no consistently significant difference was found between the two programs.

Under the combination of conditions which reflects the greatest advantage due to food stamps (less than two weeks since getting FS_2, more than two weeks since pay, in Bedford County) the difference between the dietary adequacy index of users versus nonusers of FS_2 was 9.4 percentage points of MAR. This amount of increase in the MAR index constituted about a one-seventh increase in dietary adequacy, for the average participating sample family, and would be sufficient to bring many families from an inadequate to an adequate dietary level, during the latter part of the pay month, if they bought food stamps every two weeks. However, under other conditions the improvement due to FS has considerably less impact.

For example, if it has been less than two weeks since a Bedford County family received its monthly income, the impact of FS_2 was only 3.9 percentage points increase in MAR.

In Huntingdon County no improvement in dietary adequacy could be attributed to food stamp participation. For example, an FS_1 family having purchased food stamps within the past two weeks, and whose latest receipt of income was more than two weeks ago, had an MAR only 3.6 percentage points higher than a similar family that does not use FS_1 or hasn't bought them for more than two weeks. Under the same circumstances, an FS_2 family had an MAR only 1.3 percentage points higher than its comparison group family. Neither of these differences was significant.

The effect of food stamp participation on the adequacy of dietary intake of each of the 10 nutrients was also examined. In 3 of the 4 FS surveys conducted, the iron intake of recent FS recipients was predicted to be higher (by 15 to 30 percentage points) than other low-income families, when more than two weeks had elapsed since pay day. In two of these surveys (both in Bedford County) the differences were statistically significant, and from a nutritional health standpoint, these differences in iron intake were quite important, since the iron intake was found to be inadequate (below two-thirds of RDA) in more than a fourth of the families interviewed.

Under similar assumptions, thiamin was also consumed at higher levels (18 to 36 percentage points higher) by recent FS buyers in 3 out of 4 FS surveys. And again the differences were found to be statistically significant in the two Bedford County surveys. Similar improvements were predicted, though less consistently, in the case of protein, phosphorus, riboflavin, and niacin. When less than two weeks had elapsed since pay day, however, no significant improvements were predicted in any of the 10 nutrients.

2. Participation

In Huntingdon County, nearly a fourth of the low-income sample families not using FS_1 during the initial survey had joined the program by the time of the second survey, some 15 months later. This increase in participation could have resulted from the increased financial attractiveness of the revised FS_2 program. Only one of the families reinterviewed had dropped out of FS_1 between surveys. Despite this higher participation level, however, it appears that the overall dietary adequacy of the low-income families did not improve, as discussed above.

In the Bedford County surveys, a higher dropout rate was found. More than 2 in 5 CD recipients had not begun using FS_1 at the time of the second interview (more than a month after the county had switched from CD to FS_1). Meanwhile, about 1 in 4 of the former non-CD families in the sample began using FS_1. Between Wave II and Wave III surveys in Bedford County, the FS_1 program was improved to form FS_2. When the families were reinterviewed, it was learned that 35 former FS_1 users had dropped out, and 19 of the non-FS_1 families had joined FS_2. The net effect, obviously, was an overall decline in participation among the panel of families interviewed in these surveys. This trend cannot be applied to the county as a whole, however, because the CD families were purposely over-sampled in the initial survey. The fact that a fourth of the former CD nonparticipants joined FS is numerically very important, and it portends a great increase in overall participation. This in fact seems to be the case: the trends at the county, state, and national levels indicate a strong rise in participation since the initiation of FS_2. Apparently the increase in participation is coming from the large mass of former nonparticipants.

3. Cost Effectiveness and Nutritional Efficiency

The FS_2 program embodies a considerably higher bonus value than does FS_1, in terms of the federal subsidy for the difference between the cost and redemption value of the food coupons. The average FS_2 bonus per family was about double that of FS_1 in Bedford and Huntingdon Counties. At the same time, the effectiveness of the program as a method of increasing the adequacy of dietary intake of participating families did not change appreciably. Consequently, the cost-effectiveness ratio (cost per unit increase in MAR) is much higher with FS_2 than with FS_1. However, increased participation rather than reduced cost-effectiveness seems to be the factor motivating the federal government to improve the FS program; and increased participation has been achieved.

The nutritional efficiency with which the low-income family's food dollar is spent was also analyzed, in terms of food cost per point of MAR. It appears that during conditions of relative plenty (when more ample food resources became available, either through recent purchase of FS or recent receipt of income), the family got significantly less nutritional value per dollar of food purchased. Under these conditions, nutritional efficiency was found to be significantly lower for users of FS_1 and FS_2 in Bedford County and FS_2 in Huntingdon County than for their respective comparison groups.

Nutritional efficiency must be interpreted with caution. Efficiency is not equivalent to adequacy, since families who are most nutritionally efficient may have very inadequate diets. Families with more adequate diets may be rated as nutritionally less efficient, due to their use of higher priced items such as preferred cuts of meat, which provide proportionately more taste satisfaction but less nutritional value per food dollar.

4. Food Purchases by FS Families

Food stamp families were estimated to have a somewhat higher food expenditure per person than do nonusers, other things being equal. However, in only one of the four FS surveys was this found to be a significant difference: in Huntingdon County, recent FS_2 users were predicted to spend about $8.00 per person more per month on food, as compared with nonparticipants. In most other circumstances, FS users were predicted to spend about $3.00 more, and these differences were not significant.

C. EFFECTS OF OTHER FACTORS ON DIETARY ADEQUACY

Families with incomes in the range from 100 to 125 percent of the poverty line had no better diets than those below the poverty line, other things assumed to be equal. Those with incomes greater than 125 percent of the poverty line had significantly better diets (4.5 points of MAR) compared with those below the poverty line. What would be the cost-effectiveness of a straight cash income transfer payment? Only a very tentative indication can be provided by the analysis reported here, because the surveys encompassed a relatively narrow range of income variation. Relatively few families had a major increase in income. However, for purposes of illustration, let us assume a family's income is raised from 75 percent of the poverty line to just over 125 percent. This would cost about $1860 a year for a four-person family, or roughly $5.10 a day. Given the low-income elasticity of demand for food, little of this increase (perhaps about one dollar) would go for food. If this caused a 4.5 point increase in MAR, the cost-effectiveness would be more than one dollar of public cost per point increase in MAR. (This is a very tenuous conclusion, however, and quite different results might be obtained from other surveys, such as the rural negative income tax experiment and other studies.)

The net effects of several characteristics of the household were found to be statistically significant, though very small in practical terms. For example, families of size 5 to 6 were found to have the most adequate diets (if other factors were held constant)--5.2 MAR points higher than one and two-person families. Families reporting home-produced food had significantly better diets (2.4 points) than those reporting none. Age of the homemaker was found to be negatively related; but even though the effect was statistically significant, it amounts to less than 4 points decline in MAR for a 65 versus a 25 year old homemaker.

Education of the homemaker was found not to be significantly related to the adequacy of a family's diet throughout most of the analysis. It should be emphasized that this was essentially a sample of the poor, and education beyond the twelfth grade was rare. For a broader segment of society, there could be a more significant relationship, though this question is beyond the scope of the present study.

Families were found to have significantly more adequate diets on the weekend than during week days--2.7 points of MAR.

Are the extension nutrition aides effectively improving the diets of the poor? The results of this analysis do not indicate any significant difference in adequacy of dietary intake related to the number of nutrition aide visits. However, less than 100 participating homemakers were interviewed, and this is too small a sample to allow definitive conclusions about the nutritional impact of the nutrition education program.

These and other findings of the study are presented in detail below, in Part II, Technical Report.

D. RECOMMENDATIONS FOR FURTHER RESEARCH

As stated earlier, national policy recommendations cannot be made confidently on the basis of a study of such limited scope as this one. Additional replications of the study would be required in other locations, covering a wide range of cultural and economic factors, as well as seasonal variation. The following are several specific recommendations for further research. These recommendations are predicated on the assumption that the Food Stamp program will continue in existence. This assumption is made without drawing any conclusions or making any value judgments about whether or not the program should continue. The purpose of these recommendations is to point the way for future research that could lead to improvements in the intervention programs for the poor.

1. Given that nutritional inadequacy is most likely to occur two weeks or more after the family receives its pay, a pilot study should be conducted in which an experimental group of low-income families now getting social security, retirement, and other income once a month would be given their checks more frequently than once a month. For example, one large check could be sent at the first of the month, (when most bills come due) followed by three smaller checks at one-week intervals. With computerized preparation of checks, the administrative costs would be minimal, and if major improvements in dietary adequacy occured, the cost-effectiveness ratio would be very low. This proposal may seem to be excessively paternalistic--not giving the family its entire check at one time per month. Carried to its next logical step, this argument could be used to justify giving checks even less often than once a month--perhaps quarterly or even annually. The point is that there is nothing inherently special about a month as a fiscal period. And if biweekly or weekly pay checks

would bring about the same dietary benefit as recent reception of food stamps, for example, then public policy-makers should be made aware of this fact. It is possible that the poor would prefer frequent cash payments to food stamps; presumably the cash payments could include the cash value of the food stamp bonus. This idea should be tried on a pilot basis, to see if in fact there is a tradeoff between income frequency and food stamp bonus.

2. A change in the FS regulations should also be tried on a pilot basis. Foods which have a very low dietary value per dollar of cost, as determined by nutrition specialists, could be declared ineligible for purchase with food stamps. Such foods as soft drinks and snacks that are nutritionally void would be deleted, as well as high-priced prestige items (such as high-priced cuts of meat) that may be nutritious but have a low nutritional value per dollar. There is no doubt that such foods have considerable psychic value and recreational utility for the families, and these are important. But if the Food Stamp program is to be justified as a means of enhancing dietary adequacy of low-income families, a more restrictive food list would seem desirable. Admittedly this proposal would not be enthusiastically supported by certain manufacturers of candy, snacks, and soft drinks. However, this should be tried on a pilot basis in several locations, if more cost-effective ways are to be found for improving the dietary intake of low-income families.

3. Besides providing additional food resources (whether through increased cash income payments or income in kind), it is important to seek ways to help the families use these food resources efficiently. The basic idea of the Extension Nutrition Aide program has been widely recognized as having considerable potential for improvement in diets of the families. If homemakers can be taught nutritional principles, and motivated to improve

their families' diets, this can provide major longrun benefit. However, the results of the present analysis found no significant dietary benefit from the nutrition education program. Further analysis under a broad range of conditions should be done to ascertain the extent that the diets of the poor are improved through the efforts of the nutrition aides.

4. The present study has given primary attention to the dietary effects of participation in CD and FS programs. Further analysis is needed to determine the factors underlying the participation patterns. Which types of low-income families are least likely to participate? What is the effect of enhanced FS bonus on participation? These and other questions are now being analyzed as part of another study using data from the same interviews used as the basis of this report. Replications from other locations are needed for nation-wide program inferences.

5. Research is needed to determine the relative effectiveness of in-kind versus cash aid to the poor. Specifically, if the CD retail value or the FS bonus is given to families in cash rather than through the FS program, would the same dietary benefits occur? Research is now under way using data from the rural "negative income tax experiment" in Iowa and North Carolina, for the purpose of quantifying the extent of tradeoff between CD or FS (in-kind) versus cash income transfers, as methods of improving dietary intake. Further replications in other locations would be very desirable.

PART II. TECHNICAL REPORT

A. Review of Food and Nutrition Programs

Three federally supported programs designed to enhance the dietary status of the poor have been operating in the study area: Commodity Distribution (CD), the Food Stamp Program (FS), and the Expanded Nutrition Education Program. All three of these programs (CD, FS, and nutrition education) are discussed briefly here to provide the background for this study and the review of related studies

1. Commodity Distribution Program

The Commodity Distribution Program was developed to alleviate surplus agricultural stocks. A second purpose was to provide food for the needy. Commodities are purchased by the U. S. Department of Agriculture and shipped to states and localities desiring assistance. State and local authorities in turn distribute the commodities to schools and institutions as well as to qualifying households in that state. The following discussion deals only with the assistance given to families.

Currently, 24 food items are theoretically available to participating families in the counties using the CD program. These commodities provide a nearly balanced diet for recipients. Retail value of the full package is about $16.14 per person per month. Foods distributed are as follows: beans (dry), bulgur, butter, cheese, corn meal, egg mix, flour, fruit or vegetable juice, grits, peas (dry or split), macaroni, meat (chopped), meat (poultry), milk (evaporated), milk (NFD or instant fortified), oats or wheat (rolled), peanut butter, potatoes (instant), prunes, raisins, rice, shortening, syrup (corn), and certain canned vegetables. The specific items vary from time to time among counties. The average number distributed by each administrative unit in the U. S. as of April 1969 was 18 [30, p. 23].

In Pennsylvania, an average of 14 commodities were distributed in the 16 participating counties at the time of our first survey (June 1969). [31] During the same period 13 different items were distributed in Bedford County with a retail value of $6.57 per person per month. Thus, considering the relatively low amount of food subsidy in the Pennsylvania version of the CD program at the time of our survey, it would be surprising if any significant improvement in the diet resulted from the program. Since 1969, nearly all the counties in Pennsylvania have dropped the CD programs and have adopted the Food Stamp Program. The CD program, still operating in three counties, has been expanded to include a greater number and value of commodities than were distributed at the time of our surveys. Therefore, any inferences drawn from this study with regard to the CD program must be interpreted as applying to the earlier version.

2. Food Stamp Program

The present Food Stamp Program was initiated on a pilot basis under the administration of President Kennedy in 1961. Stamps or coupons are sold to qualifying families at a price lower than their face value, the difference being the amount of "bonus" for participating. Stamps are then used to purchase food at cooperating grocery stores. Families must buy a specified amount of stamps each month at a participating bank. This is designed to insure that the family spends a "normal" amount for food and that the bonus is not diverted to nonfood expenditures. Until recently, the FS plan determined "food needs" on the basis of income as well as number in the household. Households with lower incomes received fewer stamps. As income increased within the eligible range, the FS cost increased and the amount of stamps increased. A recent change, effective in Pennsylvania April 1, 1970, provides a larger amount of stamps for families with very low incomes, and allows the dollar value of stamps to be the same for all families of a given size. The cost of the stamps is still graduated so that families having a lower income pay less for the same dollar value of stamps. On the average, families in the U. S. pay about $.40 for each dollar's worth of food stamps. Aside from the fact that families must pay to participate, this plan has advantages not present under the CD program. It gives the family the freedom to select the kinds and amounts of food desired.

It has been argued that administration of the Food Stamp Program would be more efficient than the CD program. Adoption of FS has reduced the costs for some state and local governments. Low participation has been a serious problem, but has improved with recent modifications of the program. Historically the percent of poor participating in counties where the FS program is offered has been much lower than in counties served by the Commodity Distribution Program. [14] Some of the reasons for nonparticipation are: (1) The outlay for stamps is based on what a family of a given size and a given amount of income would "normally" spend for food; since the determined "norm" is an average, some elderly families or those with small children or home produced food typically spend less, and find purchasing that amount difficult; others require much more. (2) It is often difficult for the household to accumulate the lump sum needed to buy the stamps. (3) Prior to the recent revisions, as income increased, the FS cost schedule required unrealistic increases in the amounts required to buy the stamps. (This seems less problematic with the current revision of the program.) (4) Lack of knowledge of the program and its requirements. As compared with the CD program, the food stamp program requires more individual initiative and responsibility in terms of applying for, buying, and using the stamps.

Since 1966, the number of families in the U. S. participating in the family food assistance programs has increased. Part of this increase is due to the number of counties or independent cities now administering a program.

Participation in CD has been about steady at about 3.8 million persons, while FS participation has been rising rapidly in recent months, to a current total of about 9.8 million persons (January, 1971). CD programs are gradually being replaced by FS programs in most states.

3. Expanded Food and Nutrition Education Program

The Expanded Food and Nutrition Education Program is an effort to teach low-income families the importance and the essentials of a balanced diet. This program developed from the realization that the family food assistance programs did not guarantee good diets, partly because of frequent lack of nutritional motivation or knowledge about meal planning and nutrition. In a sense, this program supplements the food assistance programs.

The Nutrition Education Program has incorporated extension techniques. Paraprofessionals (Nutrition Aides) are recruited from among the local homemakers from the community itself and are trained and supervised by Extension home economists. The aides then visit low-income families. The Extension method has the advantage of being able to approach those who, for a number of reasons, may not participate in a food assistance program. Aides have shown competence in teaching and in developing and maintaining contacts. As of October 1970, the program was operating in 929 counties and independent cities, with 6,732 program aides serving the 247,748 participating families.[1]

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[1] Recent data from Federal Extension Service, U.S. Department of Agriculture.

B. NATURE AND SCOPE OF THE SURVEYS IN BEDFORD AND HUNTINGDON COUNTIES

Huntingdon and Bedford County are adjacent, and are very similar in many ways, as shown below:

Characteristic in 1966	Bedford County	Huntingdon County
Percent of families in poverty	26	28
Number of families in poverty	3063	2967
Unemployment rate (pct.)	7.6	8.3
Percent rural population	92	71
Median years education	9	9

Source: OEO "Community Profiles."

Both counties are predominantly rural, (especially Bedford) and both have relatively high incidence of poverty. Based on these and other similarities, one might expect a similar response to the food stamp program in both counties.

1. Design of Longitudinal Surveys

In June 1969, when this study was initiated, Bedford County was one of 16 counties in Pennsylvania on the CD Program. Most counties including Huntingdon County, had switched to the FS Program, and Bedford was scheduled to do so in August of the same year. Thus Bedford provided an ideal situation for a case study of the effects of the change in program.

A sample of low-income families in Bedford County have been interviewed three times (in three waves)--twice in 1969 and once in 1970.[2/] Wave I, the first of these surveys, was taken in June-July 1969, just prior to the time when the County switched from CD to the FS Program on August 1. A total of 274 low-income families were interviewed, Table 1. August of that year the county switched from CD to the Food Stamp Program, FS_1. A month later we returned to the field with the second wave of interviews, and revisited the same families we had interviewed in Wave I. A total of 247 interviews were obtained in Wave II. Several months later, in April 1970, the Food Stamp Program was changed to FS_2. In June 1970, just one year after our first interviews, we went back with Wave III, and reinterviewed 237 of the original families.

Table 1. Program Participation of Low-Income Families in Three Interviews in Bedford County, 1969-1970.

Family Food Program Participation Status	Number of families interviewed:		
	Wave I (June-July 1969)	Wave II (Sept.-Oct. 1969)	Wave III (June-July 1970)
Commodity Distribution	177	0	0
Food Stamps	0	118	87
Non Participants	97	129	150
Total	274	247	237

A similar sample of 189 low-income families in Huntingdon County was also interviewed. In this case, a complete enumeration of all the

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[2/] CD participants were sampled at a much higher rate than were the rest of the poor, by using a systematic sample of the CD participation lists available in the county. The details of the survey design are discussed in Appendix C.

homemakers participating in the Nutrition Education Program were included in the sample, along with the random sample of low-income families, Table 2. The first wave of interviews in Huntingdon County was conducted in August 1969, while the county was participating in FS_1. The second wave was done in November of 1970 while the county was participating in FS_2. This was 7 months after the April program modification.

Table 2. Program Participation of the Huntingdon County Sample, 1969-70.

Program Participation Status	Number of families interviewed: Wave I (Aug. 1969)	Number of families interviewed: Wave II (Nov. 1970)
Food Stamps Only	20	39
Both FS and Nutritional Education	18	23
Total FS	38	62
Nutrition Education Only (not FS)	65	45
Neither Program	86	60
Total	189	167

In all of the surveys a sample of nonparticipants was included as a comparison group, thus eliminating the need for making adjustments for seasonal variations. Information was obtained on the age and education of the homemaker, the size of the household, the number of days since the family had received its latest pay, number of nutrition aide visits (if any), the number of days since it had received food aid, presence of home produced food, income, day of the week, and other relevant variables.

Thus, the same families were interviewed at crucial points in time, to provide data reflecting change in dietary intake related to changes in the food aid programs. This report is based on analysis of data from the five surveys, including the effects of switching from CD to FS, as well as the improvements in the FS program.

2. Trends in Participation After Program Change

One important effect of the change in food programs is the modified pattern of participation. In Bedford County, about 40 percent of the sample CD families dropped out when the county switched to FS_1, Figure 1. Meanwhile, about one in four of the non-CD sample families began using FS_1. As FS_1 was replaced by FS_2, 35 families dropped out and 19 joined the program. The number gained (19), however, is less than one-third of that lost (67) in the switch from CD to FS_1. Thus, it seems that the participation levels among the Bedford County panel of families did not recover to CD levels, even after the FS_2 program became effective, Figure 2. However, this overall trend apparent in the sample is not representative of the situation in the county, because CD families were purposely over-sampled. The relatively high sign-up rate among former non-users reflects the actual trend in the county, as discussed earlier.

In Huntingdon County, the food stamp program has been operating for several years, and the participation patterns are quite stable. Only one sample family dropped out, and 30 former nonparticipants joined FS_2 between Waves I and II, Figure 3.

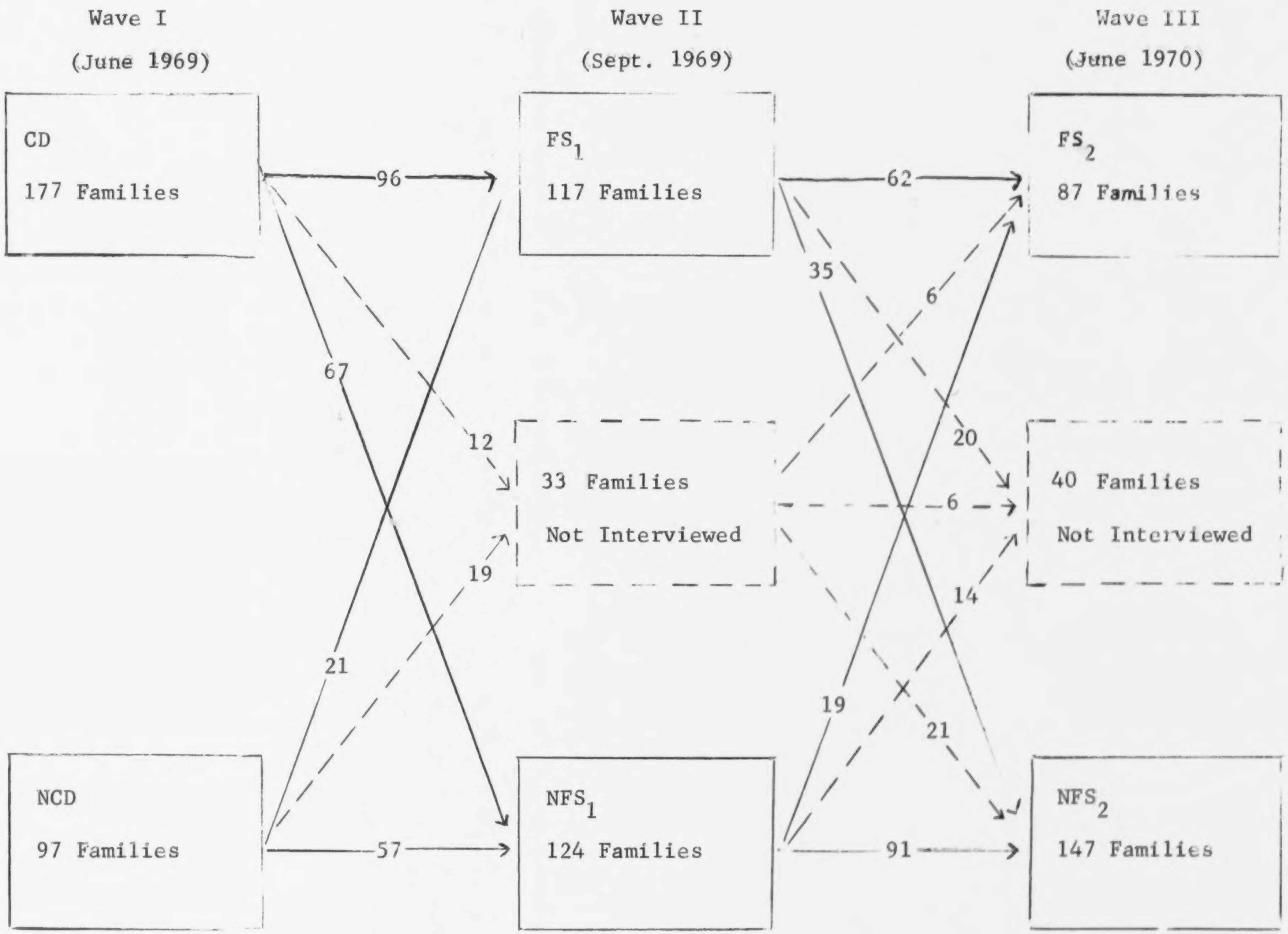
Wave I
(June 1969)
Wave II
(Sept. 1969)
Wave III
(June 1970)
CD
177 Families
FS$_1$
117 Families
FS$_2$
87 Families
33 Families
Not Interviewed
40 Families
Not Interviewed
NCD
97 Families
NFS$_1$
124 Families
NFS$_2$
147 Families
96
67
12
21
19
57
62
35
6
20
6
14
19
21
91

Figure 1. Bedford County Surveys Wave I, II and III (274 families originally interviewed).

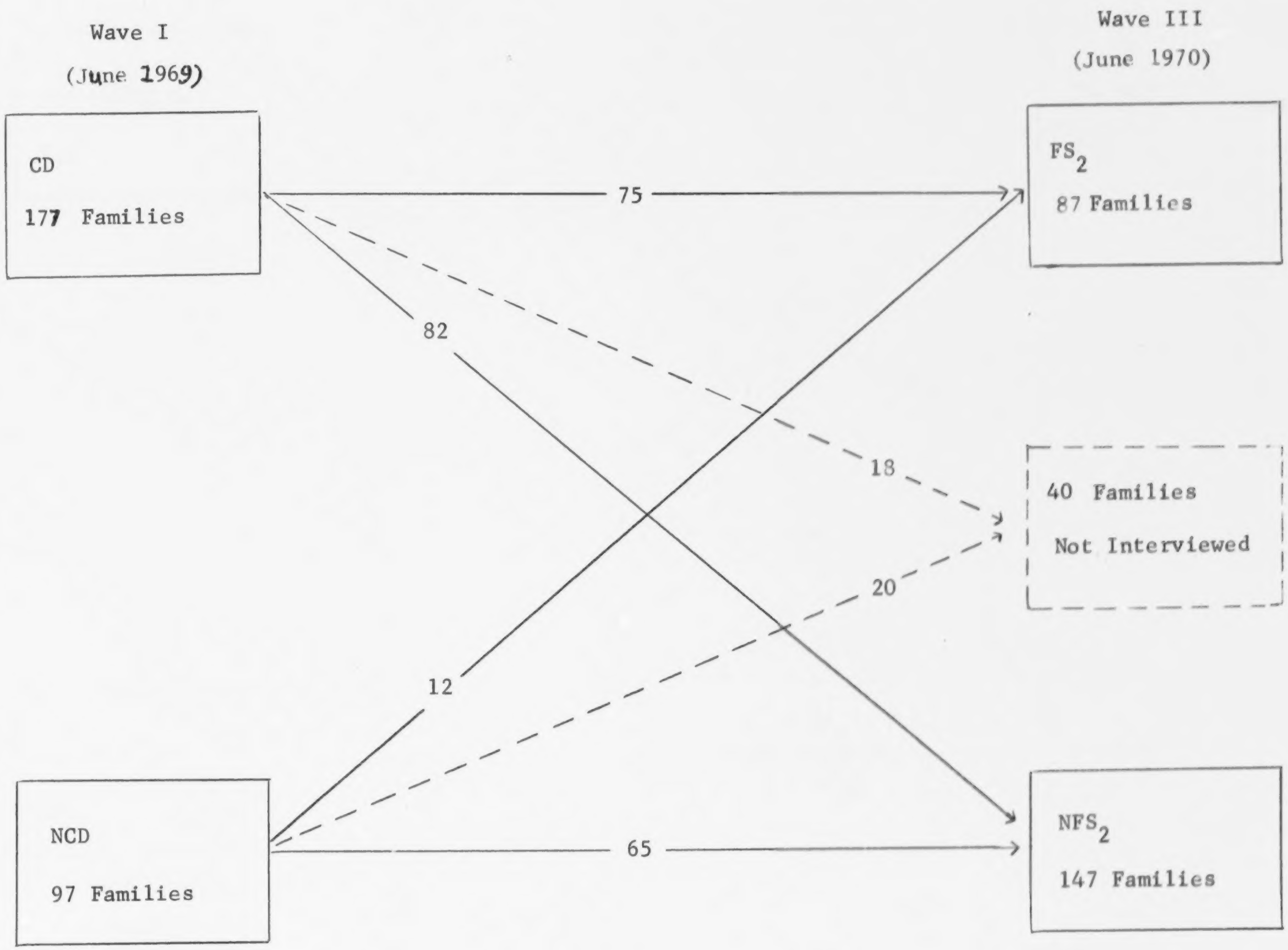
Wave I
(June 1969)
CD
177 Families
NCD
97 Families
Wave III
(June 1970)
FS$_2$
87 Families
40 Families
Not Interviewed
NFS$_2$
147 Families
75
82
18
12
20
65

Figure 2. Bedford County Surveys Waves I and III (274 families originally interviewed).

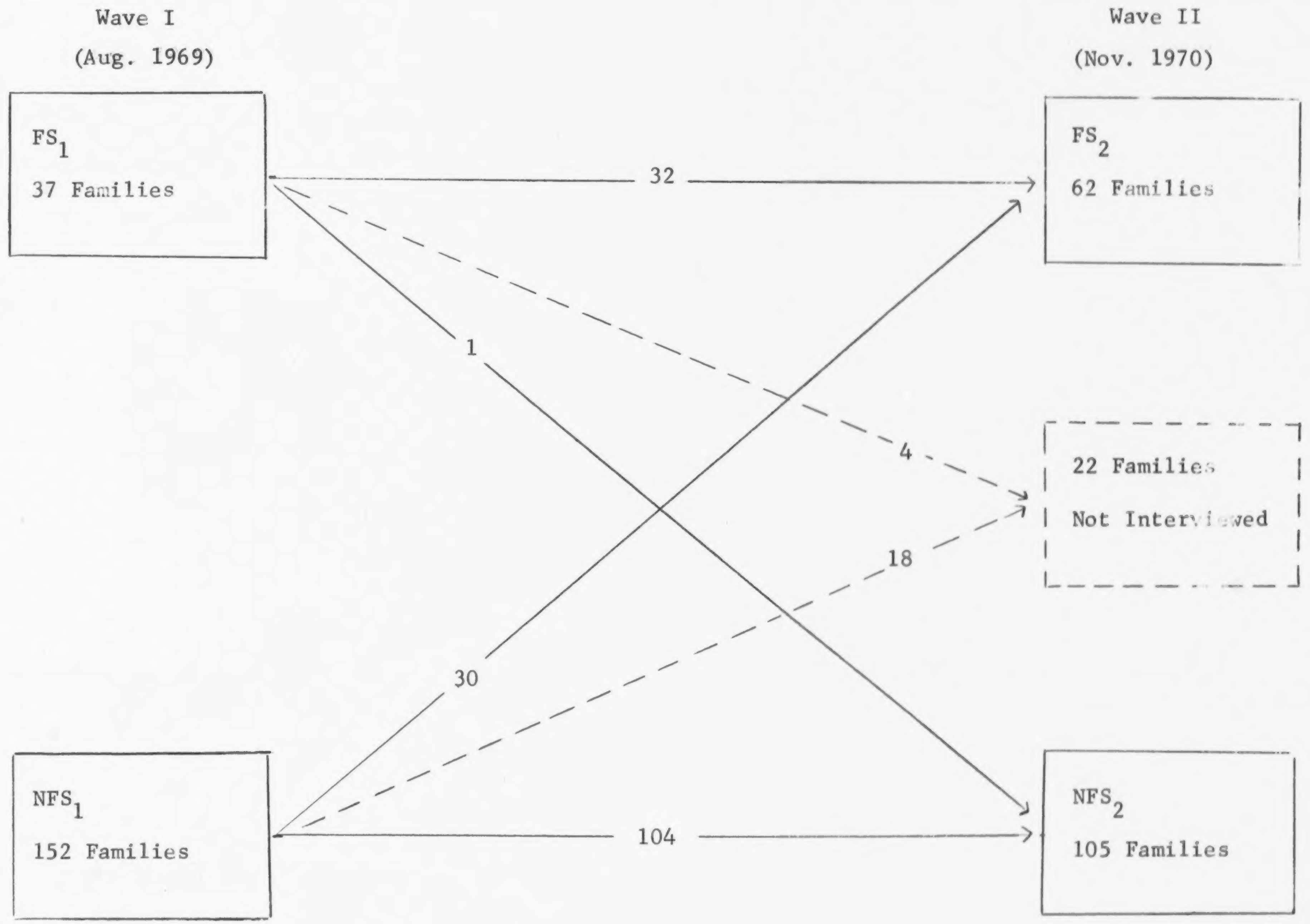
Wave I
(Aug. 1969)
Wave II
(Nov. 1970)
FS1
37 Families
NFS1
152 Families
FS2
62 Families
22 Families
Not Interviewed
NFS2
105 Families
32
1
4
30
18
104

Figure 3. Huntingdon County Survey Design, Waves I and II (189 families originally interviewed).

C. COLLECTION AND PREPARATION OF SURVEY DATA

1. Nutrient Intake Records

Several methods of measuring nutrient intake were considered for the purpose of this study. Numerous methods have been used for similar studies in the past, but no one method is best for all situations. Each appears to have advantages and disadvantages which should be pointed out.

Nutritional status is a much more complex and comprehensive concept than adequacy of dietary intake ascertained by interviews. An assessment of nutritional status, however, requires in addition several chemical and physical determinations.[3/] Although there has been some doubt about the validity of nutrient intake records as a proxy for biochemical evaluation of nutritional status, a review of 50 carefully selected studies conducted during the period of 1950 to 1967 indicates a striking consistency between the results of nutrient intake studies and the results of biochemical studies. [29, pp. 1057-1059] Three widely used techniques for obtaining food intake and consumption data are discussed below.

Seven-Day Family Food Consumption Record (Food Inventory)

This method, sometimes called the food inventory method, requires that one weigh and record the quantity of all foods in the house by kind or item before and after a 7-day period. Food brought in after the initial inventory must be recorded in the same manner. Inventories are usually performed by trained personnel and the daily records are kept by the homemaker.

[3/] The biochemical determination of nutrients, metabolites and enzyme levels of the blood, urine and tissues, and a physical examination to detect evidence of nutritional deficiencies, and anthropometric data, as determined in the National Nutrition Survey, for example.

The average consumption of food per person is calculated as follows:

1) $$\text{Equivalent persons} = \frac{\text{Number of meals served this week X number persons}}{21}$$

2) $$\text{Average consumption of food per person} = \frac{\text{Total amount of food consumed}}{\text{Equivalent persons}}$$

The family food consumption record is useful in determining "economic consumption"--the weights, quantities and cash value of food brought into the kitchen from various sources, including bought, home grown, etc. In principle, this method overstates "dietary consumption," however, if the amounts thrown away due to spoilage, waste in preparing, food fed to pets, or unused leftovers are not considered. Furthermore, this method requires a substantial amount of time and finances which in turn reduces the possible sample size. [16] In addition, there are several reasons why this method tends to introduce a bias: (1) Studies have shown the homemaker sometimes varies her buying habits as a result of being interviewed. The presence of someone recording the food inventory often creates a consciousness on the homemaker's part to buy the "proper" foods. (2) The considerable effort and time required of the homemaker may reduce her willingness to cooperate. [16, pp. 305-306]

Seven-Day Recall-List Method

The recall-list method is quite different from the one above. The interviewer asks the homemaker for a complete report of all foods used by the family during some immediately previous period, usually one week. With this method the homemaker must recall all servings of foods and their amounts for the previous seven days. This method is much less expensive than the seven-day food consumption record. In a study of these two methods, the family record and the recall-list give similar results. [16, pp. 15-16] Despite this evidence, however, it seems the difficulty of remembering seven days back would tend to increase the chances of inaccurate and incomplete reporting.

24-Hour Recall Method, with Food Models

This method, like the seven-day recall-list method, is a detailed list of quantities of various foods eaten by the family in a previous period. The nutrient intake may be calculated from the list of foods, which includes the quantities or weights of foods consumed. All food for pets, waste or leftovers are excluded, thus providing a better measure of nutritional intake as opposed to a measure of overall consumption or food demand. With this method, "food models" representing sizes of servings, containers and measures can be shown to the respondent to help him describe the size or amount of serving. This method was used by the U.S. Public Health Service in conducting their National Survey of low-income persons in 10 states. [23]

When assessing the adequacy of dietary intake of individual families, there are both advantages and disadvantages to this method as opposed to the seven-day record. The 24-hour recall interview may be taken during a day of a typically low or high intake. However, much efficiency is regained since less time and cost are involved for each record, thus increasing the potential sample size attainable with a given total cost. Compared with the seven-day food inventory, this method would tend to introduce less bias, since the respondent has no foreknowledge of the interview. Also, the memory or recall requirement is much less compared to the seven-day recall-list method. A more complete discussion of alternative methods of determining dietary intake can be found in Guthrie [7, pp. 306-308] and

Morgan. [16, pp. 12-15] In general, these studies indicate the 24-hour recall is the best method for determining the adequacy of dietary intake for large groups of respondents.[4/]

In light of these considerations, the 24-hour recall method was adopted for the present study because of the efficiency it offered as well as its appropriateness to the purposes set forth. Details of the method used in conducting the 24-hour recall are shown in Appendix A.

2. Design of the Questionnaires

The survey questionnaires for the various waves of interviews were designed to provide information concerning several characteristics of the families: household composition, income, food program status, commodity food acceptance and reasons for nonparticipation, information received on food and nutrition education, cooking facilities, food expenditure and shopping habits, sources of foods, food consumption, and transportation facilities. Information on program eligibility status for nonparticipants was based on income and assets criteria corresponding to that used by the Department of Public Assistance of Pennsylvania to determine eligibility. This also served as a screening process during the first 10 or 15 minutes of the interview. Families not on CD who did not qualify for the program by these standards were excluded from the sample.

Information on food consumption was obtained from the homemakers' recall of foods served and eaten by the family in the 24-hour period prior to the interview. A special kit of food models of various sizes and shapes

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[4/] ". . . the northeast study group recommended the one-day recall method as more efficient and equally accurate for determining the food patterns of a group." [22, p. 15] was used to help the homemaker describe sizes of servings of foods. See Appendix A for a discussion of the method used in recording and coding the dietary data.

A typical interview required approximately one hour to complete. When families were not found at home, enumerators were instructed to return to a residence a second and if necessary a third time; always at different times of the day.

3. Analyzing Food Intake Data

a. Standard Used for Measuring the Adequacy of Dietary Intake

Various measures are employed for indicating the dietary adequacy of household food intake. The measures developed for the analytical purposes of this study are based on the Recommended Dietary Allowances (RDA) proposed by the Food and Nutrition Board of the National Research Council.[5] The term "allowance" is not to be interpreted as a minimum requirement, but as a nutritional goal which will satisfy the needs of all with the exception of only extreme cases. Special nutritional needs due to health problems, such as anemia for example, are not recognized in these average allowances. However, these allowances do take into account several considerations: (1) that nutrient losses might occur in cooking and storage of food; (2) a wide range of requirements exist in the population;

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[5] An alternative standard of dietary adequacy is that being used in the analysis of data from the National Nutrition Survey (NNS) [29]. In our analysis of other data (from Iowa and North Carolina) each family's dietary adequacy is being computed with both the RDA and NNS standards. This will provide a comparison of the effects of the different standards on the program evaluation conclusions. The NNS standards are somewhat lower than the RDA in some cases, and 7 rather than 10 nutrients are considered. While these differences may yield a numerically different index of dietary adequacy, we anticipate that the program evaluation estimates will be roughly the same; i.e. the differences between the predicted MAR of participants versus nonparticipants will probably remain unchanged.

and (3) a buffer is necessary for stress conditions. Therefore, a margin of safety of from 10 to 50 percent is added to the minimum requirements depending on the nature of each nutrient. [16, p. 288]

The number of nutrients considered in this study was limited to ten since these were the only nutrients for which both RDA and food composition data (used in tabulating nutrient intake) were available. Table 3 contains the RDA for each of the 10 nutrients as follows: protein and energy (kilocalories); 3 minerals--calcium, phosphorus and iron; and 5

Table 3. Food and Nutrition Board, National Academy of Sciences: National Research Council Recommended Daily Dietary Allowances,[a] Revised 1968.*

				Vitamins					Minerals		
Age and Sex	Age[b]	Energy (Kilo-calories)	Protein (gm)	Vitamin A (I.U.)	Ascorbic Acid (mg)	Niacin (mg equiv.)[c]	Riboflavin (mg)	Thiamin (mg)	Calcium (mg)	Phosphorus (mg)	Iron (mg)
Under 10 Years:	Under 2 mo.	480	9	1500	35	5	0.4	0.2	400	200	6
	2-5 mo.	770	14	1500	35	7	0.5	0.4	500	400	10
	6-11 mo.	900	16	1500	35	8	0.6	0.5	600	500	15
	1 yr.	1100	25	2000	40	8	0.6	0.6	700	700	15
	2	1250	25	2000	40	8	0.7	0.6	800	800	15
	3	1400	30	2500	40	9	0.8	0.7	800	800	10
	4-5	1600	30	2500	40	11	0.9	0.8	800	800	10
	6-7	2000	35	3500	40	13	1.1	1.0	900	900	10
	8-9	2200	40	3500	40	15	1.2	1.1	1000	1000	10
Age 10 and Over:											
Males	10-11	2500	45	4500	40	17	1.3	1.3	1200	1200	10
	12-13	2700	50	5000	45	18	1.4	1.4	1400	1400	18
	14-17	3000	50	5000	55	20	1.5	1.5	1400	1400	18
	18-21	2800	60	5000	60	18	1.6	1.4	800	800	10
	22-34	2800	65	5000	60	18	1.7	1.4	800	800	10
	35-54	2600	65	5000	60	17	1.7	1.3	800	800	10
	55+	2400	65	5000	60	14	1.7	1.2	800	800	10

*Designed for the maintenance of good nutrition of practically all healthy people in the U. S. A.

Table 3. (continued)

Age and Sex	Age[b]	Energy (Kilo-calories)	Protein (gm)	Vitamin A (I.U.)	Ascorbic Acid (mg)	Niacin (mg equiv.)[c]	Riboflavin (mg)	Thiamin (mg)	Calcium (mg)	Phosphorus (mg)	Iron (mg)
Females	10-11	2250	50	4500	40	15	1.3	1.1	1200	1200	18
	12-13	2300	50	5000	45	15	1.4	1.2	1300	1300	18
	14-15	2400	55	5000	50	16	1.4	1.2	1300	1300	18
	16-17	2300	55	5000	50	15	1.5	1.2	1300	1300	18
	18-21	2000	55	5000	55	13	1.5	1.0	800	800	18
	22-34	2000	55	5000	55	13	1.5	1.0	800	800	18
	35-54	1850	55	5000	55	13	1.5	1.0	800	800	18
	55+	1700	55	5000	55	13	1.5	1.0	800	800	10

[a] The allowance levels are intended to cover individual variations among most normal persons as they live in the United States under environmental stresses. The recommended allowances can be attained with a variety of common foods, providing other nutrients for which human requirements have been less well defined.

[b] Entries on lines for age range 22-35 years represent the reference man and woman at age 22. All other entries represent allowances for the mid-point of the specified age range.

[c] Niacin equivalents include dietary sources of the vitamin itself plus 1 mg. equivalent for each 60 mg. of dietary tryptophan.

vitamins--vitamin A, three of the B vitamins (thiamin, riboflavin and niacin)[6], and vitamin C (ascorbic acid). The RDA for each nutrient varies by the age and sex of the person. For a given nutrient, the RDA for a family is calculated on the basis of the age and sex of each person.

For purposes of the present analysis, an "adjusted RDA" was used as the basis for measuring the adequacy of dietary intake. The adjustment is a proportional reduction of the RDA for any meal eaten away from home during a 24-hour period. For each nutrient analyzed, this proportional reduction was based on the proportion of the total nutrient intake eaten at each meal by the sample families who ate no meals away from home. This procedure assumes that meals eaten away from home provided the same proportion of nutrients as the meals at home.[7] This assumption seems superior to an assumption often used--that each of the 3 meals provides a third of the intake of each nutrient.[8] This adjustment makes the standard comparable with the dietary intake data for meals eaten at home.[9] For families that consumed all their meals at home, the "adjusted RDA" is exactly equal to the RDA; for others it is smaller.

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[6] It should be noted that niacin actually available for use in the body is underestimated here, since niacin can be converted from excess tryptophan (in protein) within the cell. Niacin adequacy as discussed in this study is based solely on niacin intake in the form of niacin and not as derived from protein.

[7] This assumption was tested empirically, and a small adjustment was subsequently made. It was found that, in a multiple regression model, the index for adequacy of dietary intake (MAR, discussed below) was found to be biased downward by about 0.06 percentage points for each one percentage point increase in the index of proportion of meals eaten away from home (PMA). For example, a family reporting 20 percent of its meals away from home would have an MAR biased downward by 1.2 percentage points. This amount of bias was statistically significant (at the 0.05 level of probability), but in effect it was trivial. When adjustments were made for this bias, the resulting conclusions (with regard to food program effects, etc.) did not change. Perhaps in other studies an adjustment will prove to be more critically needed. If so, the adjustment factor can be computed by including the PMA index as an independent variable in the multiple regression model with MAR as dependent variable. The PMA index is computed simply as one minus the ratio of adjusted RDA to unadjusted RDA of a specific nutrient.

A computer program was designed to tabulate nutrient intake from the "24-Hour Recall" (food records) for each household and to determine the Recommended Dietary Allowance which can be used as a standard of comparison for that household. The computer program, Nutrient Intake Tabulator and Evaluator (NITE), is composed of three phases:

Phase I. Nutrient Intake for Each Household

Phase II. Percent of Total Nutrient Intake Obtained at Each Meal

Phase III. Recommended Dietary Allowances (RDA) for Each Household

A detailed description of the NITE program is available from the authors. A brief description of the computing logic follows.

b. Computing Nutrient Intake of Each Household

The nutrient intake of each household is tabulated for 10 nutrients (e.g., gms. of protein, mgs. of Vitamin C, etc.) by considering each food and the amount consumed by the household. The amount of each nutrient in 100 grams of each of 2483 foods was compiled on magnetic tape from the standard sources, "Composition of Foods, Raw, Processed and Prepared," Agricultural Handbook No. 8, USDA, (1963). A few additions and corrections were made in the published data from an errata sheet supplied by USDA, prior to the analysis.[10] The amounts of each nutrient contributed by a particular food were added for all foods consumed by a household, to determine the total amounts of intake for each nutrient. For foods recorded in volumetric units or quantity measures, a table of food weights compiled from a number of standard sources provided the basis for conversions from volume or quantities to weight (see Appendix A).

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[8] That each of 3 meals provides one-third of the intake of each nutrient, is implied in the method of calculating the RDA for the household, used in some studies; see Morgan [16, p. 15]

[9] Between-meal consumption is excluded when computing the adjusted RDA for each person in the family. This was done under the assumption that a person's between-meal consumption away from home would be proportionate to the meals eaten away from home.

c. Adequacy Measures of Individual Nutrients

For each of the 10 nutrients analyzed, an adequacy ratio was computed for each family, based on the family's intake and adjusted RDA of each nutrient. Taking energy (kilocalories) as an example, "the energy adequacy ratio" is a ratio of the total kilocalorie intake for the household during a 24-hour period divided by the adjusted RDA for energy (kilocalories). If this ratio is less than two-thirds, the household is said to have an "inadequate" intake of energy during that 24-hour period. A ratio of 1 denotes a dietary intake equal to the adjusted RDA.

It should be emphasized that the dietary intake data obtained from the 24-hour recall are not intended as an accurate indicator of the nutritional adequacy of any individual family.[11] Rather, these data are intended to be used to indicate comparisons among large groups of families. Due to the day-to-day variation in the dietary pattern of the families, one would ordinarily expect the responses obtained from individual families to be subject to considerable random variation. For example, the family's intake of Vitamin A on the interview day may be extremely low (e.g., 20 percent of the RDA) and this may be an abnormal day in this respect. But when large groups of observations are analyzed, these individual variations tend to average out, so that the inherent differences between two or more groups may become apparent. The idea of the validity of inter-group comparisons is a key concept in the development of an overall indicator of dietary adequacy for each family, based on the information obtained in the 24-hour dietary recall.

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[10] Separate tabulations were made for families receiving CD foods using nutritive values as given by Feeley and Watt [6] for those whose composition differed from foods given in Handbook No. 8. Although some of these foods were enriched with vitamins, they sometimes had lower nutritive values than most comparable foods found in Handbook 8 (e.g., dehydrated egg mix).

[11] Two of the reasons why errors may occur are: (1) Some members of the family may get less than "their share" of certain foods. Thus, even though the family's overall dietary intake may appear adequate in total, some members of the family may be receiving an inadequate diet. (2) Certain members of the family may have special dietary needs not reflected in the RDA--anemia for example. Both of these possible sources of error are recognized; both lie beyond the scope of the present study and are ignored.

While individual nutrient adequacy measures are useful in determining particular nutritional inadequacies or intake patterns among various groups, interpretation of the overall impact of food programs using a number of measures is sometimes impractical. Conflicting indications among nutrients may confuse the interpretation of the overall effect of the program. A way of combining individual nutrient measures to develop an overall index of dietary adequacy helps to facilitate the kind of analysis reported here.

d. Alternative Indexes to Represent Overall Dietary Adequacy

Most studies concerned with dietary adequacy or nutritional status have adopted 67 percent of the Recommended Dietary Allowances (RDA) as "adequate" under the assumption that diets supplying nutrient levels below this amount might indicate a "suboptional state of nutrition". [7, p. 309] It is also true that a persistent deficiency in just one nutrient, even with a very adequate intake in all other nutrients, may cause serious health problems or illnesses. Thus it seems appropriate to use an index which will take into account the critical level as well as the serious effect of deficiency in any one nutrient. Three alternative indexes were designed and considered for purposes of this study. The least sensitive of these is discussed first.

"Meets 10:"

This index is given a value of "one" if the intake of all ten nutrients met or exceeded the 67 percent level of RDA; but if the intake of any one nutrient was below the 67 percent level, the family is assigned a "Meets 10" index value of 0. While this index is useful to point out the number of families whose dietary adequacy is above and below a very critical point, it does not detect variations within the ranges above or below that point. Extremely low intake is coded the same as intake just slightly below the 67 percent level. This feature is highly undesirable for purposes of the kind of multivariate analysis reported here.

"Nutrient Sum:"

A second index of overall dietary adequacy was calculated for each family, based on the critical point (i.e., 67 percent level) of each of the ten nutrient adequacy ratios. The "nutrient sum" is simply the total number of nutrients for which the family's intake meets or exceeds the 67 percent level of the adjusted RDA. The "nutrient sum" is a whole number between 0 and 10; it is more sensitive to variations than the "Meets 10" index, which has a value of either 0 or 1. The "nutrient sum" shares the rigor of the first index, in that over-consumption of one nutrient will not compensate for an under-consumption of another nutrient, no matter how high or low the level of intake. A major weakness of this index was noted, however, for the purposes of this analysis. Since the adequacy ratios of various nutrients tend to be positively correlated, it is not unusual to find a family for which all or nearly all of the nutrient adequacy ratios are just above or just below the 67 percent level. As an extreme example, one family may have a 66 percent adequacy level in all ten nutrients and thus its "nutrient sum" would be 0. A second family may have a 67 percent adequacy level in all ten nutrients for a nutrient sum of 10. This wide difference in "nutrient sum" (0 versus 10) is too extreme to accurately reflect the observed difference in dietary adequacy in this hypothetical example--66 versus 67 percent for each nutrient ratio. Thus, a more reasonable alternative was sought which would be less sensitive to any particular adequacy level and more sensitive to all levels within a reasonable range.

"MAR:"

A third overall index of dietary adequacy was calculated for each family, based on the ten nutrient adequacy ratios. This index, called Mean Adequacy Ratio (MAR) is calculated as the simple average of the ten adequacy ratios. For this purpose, each of the nutrient ratios was truncated at a maximum value of 1.0, or an intake 100 percent of RDA. This was done to prevent a gross over-consumption of one nutrient from compensating for an under-consumption of another nutrient in the calculation of the MAR index. This truncating was found to be necessary to avoid distortion due to extremely high consumption of some nutrients. For example, one family which consumed an extremely large amount of liver, had a Vitamin A intake more than 10 times the RDA. This procedure is consistent with nutrition theory, in that a high level of consumption of one nutrient does not generally compensate for a low intake of another. A family whose intake of all ten nutrients was at 100 percent or more of the RDA levels would have an MAR index of 100, for example. In cases where the family's consumption of one or more nutrients is less than 100 percent of RDA, and MAR index will be less than 100. In the hypothetical example mentioned above, if all of the nutrients are consumed at the level of 66 percent of RDA, then the MAR index would be 66, while a family consuming each nutrient at the 67 percent level would have an MAR of 67.[12]

The MAR index shares the general defect of the 24-hour recall as a measure of dietary adequacy for an individual family; it is designed for use with groups of data. It should be noted, for example, that a small amount of inter-nutrient compensation is allowed within the range under 100 percent of RDA. For example, if the Vitamin A adequacy ratio was 0.8 and the Vitamin C adequacy ratio was 0.6 and all the other nutrient ratios were 0.7, then the MAR statistic would be calculated as 70. In this case, the slightly higher consumption of Vitamin A would be allowed to offset the slightly lower consumption of Vitamin C. This small degree of averaging clearly would not seriously distort the MAR as a general index of dietary adequacy for purposes of group comparisons. A somewhat more extreme case, one which seems to occur only rarely, is where the adequacy ratio is extremely low for one nutrient (20 percent of RDA for Vitamin C, for example) yet the adequacy ratio approaches or exceeds 100 percent for all the other nine nutrients. If this information were taken literally as representing the family's usual diet, then the acute deficiency of the one nutrient would render the diet "deficient," for serious health problems may occur if even one nutrient is critically short for a sustained period.

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[12] The MAR index is a simple arithmetic mean of the ten nutrient adequacy ratio. Equal weights were ascribed to the various nutrients, because all are essential. If food composition data and RDA were available for other essential nutrients, these also would have been included in MAR.

The MAR index, by virtue of being an average, tends to obscure extreme deficiencies in individual nutrients. In practice, however, the adequacy ratios of the various nutrients tend to be positively correlated. The usual situation is for the adequacy ratios to be similar. If one nutrient is deficient, several are deficient, reflecting an inadequate intake of a particular food group, and consequently the MAR index reflects these deficiencies by being rather low.

For further comparison of overall dietary indexes, simple correlations were calculated between these and individual nutrient ratios (Table 4). The nutrient sum and MAR (variables 11 and 12, respectively) are very highly correlated -- r = 0.963. The question arises, which of these overall dietary adequacy measures is more highly correlated with each of the ten individual nutrient ratios? Table 4 shows that MAR is slightly more highly correlated. It is not possible to calculate meaningful correlation coefficients with the "Meets 10" index, since the only values this variable can have are 0 and 1. MAR 67 (variable 13 on the same table) is similar to the MAR, with one exception: MAR 67 is calculated by truncating each of the nutrient ratios at 67 percent rather than 100 percent. MAR 67 is very highly correlated with MAR (r = 0.934) and with nutrient sum (r = 0.870). However, MAR 67 is not as highly correlated as MAR with the individual nutrient ratios. The results of this correlation analysis supports our tendency on a priori grounds to prefer the MAR as a measure of overall dietary adequacy, for purposes of the present analysis. The question remains, how well does the MAR reflect the levels of individual nutrients? How sensitive is the MAR to an improvement in dietary intake? How large an increase in food intake is needed to enhance the MAR by one point? And, from an economic point of view, what is the cost of enhancing the MAR by one point, through addition of various food items to the diet? These questions are

Table 4. Correlations Between Individual Nutrient Adequacy Ratios and Overall Dietary Adequacy Indexes. (Wave I Bedford County;

VARIABLE	No.	1	2	3	4	5	6	7	8	9	10	11	12
ENERGY	1	1.000											
PROTEIN	2	0.706	1.000										
CALCIUM	3	0.553	0.483	1.000									
PHOSPHOROUS	4	0.756	0.771	0.772	1.000								
IRON	5	0.632	0.662	0.295	0.645	1.000							
VITAMIN A	6	0.528	0.464	0.370	0.468	0.465	1.000						
THIAMIN	7	0.636	0.723	0.412	0.622	0.682	0.319	1.000					
RIBOFLAVIN	8	0.693	0.845	0.740	0.822	0.571	0.503	0.715	1.000				
NIACIN	9	0.687	0.755	0.246	0.641	0.719	0.374	0.694	0.618	1.000			
VITAMIN C	10	0.281	0.269	0.127	0.205	0.293	0.363	0.396	0.306	0.337	1.000		
NUT. SUM	11	0.693	0.786	0.550	0.736	0.637	0.526	0.680	0.756	0.662	0.449	1.000	
MAR	12	0.711	0.824	0.565	0.762	0.674	0.547	0.712	0.802	0.698	0.493	0.963	1.000
MAR 67	13	0.560	0.687	0.458	0.614	0.559	0.448	0.580	0.667	0.565	0.466	0.870	0.934

answered in the following sections, as a means of making more tangible the meaning of the MAR index.

e. The Need for Individual Nutrient Ratios in Conjunction With MAR.

The MAR index is very highly correlated with several of the individual nutrient ratios; e.g. 0.82 for protein, 0.80 for riboflavin, etc. However, the MAR is less highly correlated with the ratios for Calcium (0.57), Vitamin A (0.55), and Vitamin C (0.49). These relatively low correlations are to be expected, in view of the fact that these three nutrients are seldom found abundantly in the same foods. Another indication of the independence of these nutrients is their low correlation with each of the other nutrients. For example, all of the correlations between Vitamin C and the other nutrients are below 0.4; and its correlation with calcium is only 0.127. These findings lead to the procedural conclusion that, while the MAR is a useful index of overall dietary adequacy for program evaluation purposes, some of the individual nutrient ratios should be considered separately as well.

f. MAR Sensitivity as a Measure of Dietary Adequacy

In order to illustrate the sensitivity of the MAR both to the quantity and types of foods consumed, the MAR of several size 4 families was calculated before and after adding certain hypothetical quantities of certain foods to their actual intake, Table 5.

In general, the lower a family's intake the more benefit it derives from the addition of food--especially the more complete foods such as milk. Consider, for example, the effect of an added quart of milk per day to the observed intake of two families. Family 1 had an MAR of 43, compared with 78 of Family 2. When a quart of milk is added to their observed 24-hour intake, the MAR of Family 1 increases by 34 points, while that of Family 2 goes up by only eight points. The contrast is even sharper in the case of adding orange juice, because Family 1 was initially more deficient in Vitamin C than Family 2.

Other families shown in Table 5 exhibited a greater or smaller improvement, depending on their initial position, and the specific nutrients in which they were deficient. When a pound of hamburg is added in addition to the quart of milk, the MAR rises by an additional 16 points in the case of Family 3; but this meat provided no further improvement in the case of Family 4, whose MAR was brought up to 99 by the quart of milk alone. Family 5 gains substantially from milk plus meat. What if rolled oats rather than milk or meat is added to the dietary intake? Family 5 gains relatively little from the addition of rolled oats (+6 points) while Family 6 showed essentially as much improvement from oats (+20 points) as from milk.

Table 5. Sensitivity of MAR Illustrated by the Addition of Hypothetical Quantities of Selected Foods to the Actual Daily Intake of Selected Four-Person Families.

Family Number	Actual MAR	Change in MAR After Increasing Daily Intake by:			
		1 Quart Milk	1 Quart Milk Plus 1# Hamburg	1.33 Cups Rolled Oats	16 Ounce Orange Juice
1	43	+34	+44	+33	+38
2	78	+ 8	+12	+ 2	+ 3
3	46	+30	+46	+36	+43
4	82	+17	+17	+16	+16
5	67	+13	+22	+ 6	+ 3
6	71	+20	+23	+20	+20

Thus, a family whose intake is deficient in certain nutrients contained in a given food will benefit more than will a family already consuming an adequate level of these nutrients. The magnitude of improvement in MAR that can be caused by an increase in intake of certain foods may range from zero to more than 40 points, in the examples shown here.

Likewise the cost of increasing the MAR varies from family to family, and from one assumed food to another, Table 6. The cost per day for improving the diet of Family 1 is less than 1¢ per point increase in MAR, if we assume the family consumes an additional quart of milk. In contrast, Family 2 has a far better diet initially, and the comparable cost figure is more than 3¢ per day per point increase in MAR.

These examples illustrate the amount by which the MAR of a four-person family could be increased by the addition of a modest amount of food to the family's diet, and the daily cost of enhancing the diet by these amounts.

Table 6. Cost-Effectiveness -- The Cost Per Point of Increase in MAR of a Four-Person Family by Addition of Hypothetical Quantities of Selected Foods.[1]

Family Number	Actual MAR	Cost Per Point Increase in MAR by Adding:[2] 1 Quart Milk (Cost: $0.28)	1 Quart Milk Plus 1# Hamburg (Cost: $0.90)	1.33 Cups Rolled Oats (Cost: $0.05)	16 ounce Orange Juice (Cost: $0.22)
			Dollars Per Day		
1	43	.008	.020	.002	.006
2	78	.035	.075	.025	.073
3	46	.009	.020	.010	.005
4	82	.016	.053	.030	.014
5	67	.032	.041	.080	.073
6	71	.014	.039	.030	.011
			Dollars Per Month		
1	43	.24	.60	.06	.18
2	78	1.05	2.25	.75	2.19
3	46	.27	.60	.03	.15
4	82	.48	1.59	.09	.42
5	67	.96	1.23	.24	2.19
6	71	.42	1.17	.09	.33

[1] Refers to increase in MAR shown in Table 5.

[2] Prices taken from Bureau of Labor Statistics for 1969.

D. DIETARY ADEQUACY--A CONCEPTUAL MODEL

The adequacy of a family's dietary intake at any point in time may be influenced by a wide range of factors, both within and outside the family. Two major categories of relevant factors are (1) the family's food purchasing power, or more generally, its access to food, and (2) the nutritional efficiency with which the homemaker uses the food resources, in terms of the types of food obtained and the manner in which it is prepared and cooked for the family.

1. Factors Affecting Access to Food

Access to food or the resources needed to obtain food are obviously related to income, but other factors are also relevant.

1. The family's income--particularly the discretionary income which remains after the bills are paid (rent, utilities, installment credit accounts, etc.). Families with acute shortages of money frequently are faced with pressing needs, such as a rent bill or a car payment that must be paid, or a health crisis, which takes precedence over food expenditure for use of the limited funds.

2. Income includes the amount of real income supplement a family derives from participation in a food assistance program. This varies with several factors. With the CD program, the value of foods distributed is essentially a constant amount per person per month. This amount will vary from one state to another, depending on the commodities accepted by the State from the federal government. Over time the amounts also vary, as commodities are added to or dropped from the CD list. The amount of real income supplement derived from the CD foods will be generally less than their retail value, for families who would not have purchased or do not use certain commodities.

The real income supplement accruing from the food stamp program is essentially the difference between the face value and the cost of the stamps. This amount of bonus diminishes as the family's income rises. Conceptually the cost a family must incur to participate (e.g., transportation to the bank, etc.) must be deducted from the bonus in arriving at an increase in real income. Obviously only a small fraction of an increase in income or a real income supplement will be spent for food. It is not known whether the income elasticity of demand for food is the same for real income supplements (e.g. FS or CD) as for cash income.

3. Number of days since receipt of income and frequency of pay are very relevant. Important variations in food access occur within the family's financial budgeting period (usually a month). Late in the pay month, many families--particularly the poor--tend to run short of food. This may be less likely to occur in families receiving a significant amount of pay two or more times during the month.

4. The same type of time relationship seems likely to prevail with regard to the length of time since food assistance (CD or FS) has been received. Caseworkers, extension nutrition aides, and others have repeatedly seen evidence that several of the more palatable commodities (e.g., fruit juice, canned meat) are used up during the first few days after they are distributed. The same may be true to a certain extent with regard to the food stamps. One of the purposes of the present study is to see whether the benefit of food program participation fades out, and to determine the extent to which food assistance compensates for the lack of food resources late in the pay month.

5. Family size is obviously an important factor in determining the adequacy of a family's food resources at a given income level. For this reason, a relative income index (income divided by the poverty line) is

used as a measure of the family's economic well-offness. This income-poverty ratio has a value less than 1.0 for families below the poverty level of income. Given the fact that the official poverty line has been established at a level considerably below the amount of money needed to buy all the basic necessities [14] one should expect inadequate food intake to occur at or above the poverty line, due to lack of access to food resources.

Likewise, the increase in food resource adequacy due to the real income supplement from CD or FS will depend on the size of the family. For this reason, the bonus per person seems relevant to the overall dietary adequacy. Given the tendency for benefits to fade with increasing time since receipt of food aid, it seems reasonable to hypothesize that bonus per person per day since receiving food aid would be significantly related to food availability and to adequacy of dietary intake.

6. Home-produced foods (gardens, milk cows, etc.) can be an important source of food, especially during the summer and fall.

Given the amount of food resources available to the family, the question remains how efficiently are these resources used?

Factors Affecting Nutritional Efficiency

The use of food resources is influenced by a wide range of factors related to nutritional knowledge, homemaker skills, and her aspirations for a more nutritious diet. Cultural factors are important, in that traditional food habits are difficult to change.

1. Educational attainment of the homemaker is generally expected to have a beneficial effect on the dietary level of the family. However, a higher level of educational attainment, measured in years of school completed, is not an accurate indicator of the nutritional knowledge of the homemaker.

Nor does it necessarily indicate a higher aspiration for improved diet. Homemakers with college education are more likely to overcome traditional food patterns and cultural barriers, but such high levels of education are seldom found among the poor. Most homemakers in poor families have less than a high school education. Thus, one should not expect higher levels of homemaker education, within this range of observations, to have a strong effect on the diets of the poor families.

2. Number of nutrition aide visits should improve the nutritional efficiency in use of food resources. The aides encourage the homemaker to obtain and prepare more nutritious foods for her family. It should be recognized, however, that the families with the least adequate diets are frequently the most resistant to changes in dietary behavior. Often the aide finds such severe problems of health, clothing, and housing that she is unable to get the homemaker interested in nutritional information. Many preliminary visits are often needed before any improvement in dietary behavior could reasonably be expected. Even then, some homemakers may choose not to change their food patterns. Therefore, it does not seem reasonable to expect an immediate transformation from inadequate to adequate diets as a result of a certain number of nutrition aide visits.

3. Age of the homemaker is generally expected to be negatively related to dietary adequacy. Older people seem to place relatively low emphasis on food than do younger families--particularly those with children.

4. Family size should be relevant for the same reason: one- and two-person families would be expected to have less adequate diets than larger families.

5. Day of the week is thought to have an important effect. On weekends, particularly Sunday, many families customarily have a larger meal than usual. Whether or not this is true among the poor is open to question.

6. Income adequacy may also exert an important influence on the nutritional efficiency with which the family uses its food resources. Families with low income may feel forced to buy the lower priced cuts of meat, which are a more economical source of nutrients than are the higher priced cuts. On the other hand, it must be recognized that food provides a broader range of utility than just nutritional value. Variety in the diet is also considered a desired end. Specialty food products, snacks, and convenience foods have a definite recreational value, in providing easier meal preparation and variety. The poor families who feel deprived in other ways may choose to compensate by buying such food items, many of which may be very low in nutritional value. Thus, it is not clear on a priori grounds what net effect a marginal change in income would have on the nutritional efficiency with which a family uses its food resources.

7. Adjustment lag may be apparent in a family's dietary behavior. That is, soon after adoption of a food program or a major change in the nature of a program, families may have different food purchasing patterns than would be true after a longer period of adjustment to some sort of "equilibrium position". When surveys are taken very soon after a program is adopted, participating families may not have reached an equilibrium behavior pattern, thus giving misleading results. For example, the FS_1 survey in Bedford County (Wave II) was conducted 1 to 3 months after the food stamp program went into effect, whereas the FS program had been operating in Huntingdon

County for several years. In both counties, new families were signing up for food stamps each month. The extent of adjustment lag is not known, but its effect is not thought to be significant, and it has been ignored in the present study.

The ideas underlying this conceptual model were taken into account in defining and computing the variables for the analysis, and in devising an analytical model for testing the hypotheses implied by the conceptual model. Before proceding to the analysis, the survey results are summarized to provide a more concrete idea of the characteristics of the sample.

E. SUMMARY OF SURVEY DATA BY DIRECT TABULATIONS

Data collected by the 24-hour dietary recall are usually analyzed for groups of families rather than by individual family, because food or nutrient intake of a single day may not be a good indication of the average daily nutrient intake for a household. There are right ways and wrong ways of aggregating the data, however. This may be done simply by adding together the dietary intake for a group of households representing consumption on various days of the week, and under a variety of conditions, and combining the observations into aggregate group average intake values, which are then compared with aggregate requirements for the same nutrients. This aggregate method has a serious weakness in that distribution within the group is obscured. That is, it may appear that diets are adequate for all households since the total consumed equals or exceeds the total needs, while in fact, inadequate intake of some households is offset by the overconsumption of others. In an attempt to avoid this error, the adequacy ratios were computed separately for each family. Direct tabulations were made of the nutrient adequacy ratios -- program participants versus nonparticipants, for example, averages of the nutrient ratios were also computed. The results of these and other tabulations are presented below:

1. Dietary Adequacy

Several measures of dietary adequacy were computed from the survey data. The individual nutrient adequacy ratios may be used as an indication of nutrients that are most severely lacking. Average values of the various nutrient adequacy ratios are shown in Table 7, where recent program

Table 7. Average Sample Values of MAR and Nutrient Adequacy Ratios for Ten Individual Nutrients, for Families Receiving Food Assistance Within the Past 14 Days. Versus Nonparticipants at Same Location and Time, Bedford County.

Item	Wave I		Wave II		Wave III	
	$CD \le 14$	NCD	$FS_1 \le 14$	NFS_1	$FS_2 \le 14$	Others
n 1/	66	89	67	112	64	154
MAR	82.6	82.3	82.6	78.3	72.4	66.9
Energy	97.0	98.9	91.0	88.4	70.3	65.6
Prot.	142.4	132.6	140.3	118.8	118.8	100.0
Calc.	75.8	82.0	83.6	75.0	59.4	58.4
Phos.	121.2	129.2	128.4	119.6	103.1	94.8
Iron	98.5	100.0	88.1	91.1	81.3	71.4
Vit. A	86.4	82.0	88.1	84.8	73.4	65.6
Thia.	104.5	109.0	116.4	99.1	93.8	81.2
Ribo.	113.6	112.4	119.4	104.5	93.4	81.8
Nia.	107.6	109.0	116.4	100.9	95.3	80.5
Vit. C	104.5	112.4	110.4	102.9	73.4	73.4

1/ The sample size in each cell (n) varies slightly from one table to another in this report. The reason is that not all the respondents provided complete questionnaires, and observations with missing data were deleted for some tabulations and not for others.

participants (those receiving CD or purchasing FS within two weeks prior to the interiew) are compared with nonparticipants. In Bedford County during Wave I, it appears that energy (kilocalories) was not lacking, in that the average energy adequacy ratio for recent CD recipients was 97 percent of RDA; that for nonparticipants was 98.9 percent of RDA. Table 8 shows, however, that one in four (24 percent) of the families had energy intake less than two-third of RDA. This comparison highlights the fact that distributional data reveals problems covered up by averages. The same is true to an even greater degree in the case of Vitamin A. The average adequacy ratio for Vitamin A was over 82 percent (Table 7), yet roughly half (45 and 56 percent for CD and NCD respectively) of the sample had intakes below two-third of the RDA. It is interesting to note in this connection that a higher percentage of food program participants than nonparticipant had diets inadequate in Vitamin C. Again, this pattern was not found consistently among all the nutrients. The opposite was true, for example, in the case of Vitamin A; 45 percent CD families versus 56 percent of NCD families had intake less than two-third of RDA. Adequacy ratios for protein, phosphorus, and the vitamins all are high on the average, yet in each case a substantial number of families reported intake less than two-third of RDA.

How can we interpret findings such as this - that a fourth of the families interviewed in Bedford County reported inadequate energy intake (less than two-third of RDA) and half the sample reported inadequate Vitamin A? Can we conclude that this many poor people are "starving" in central Pennsylvania? This kind of conclusion is clearly not warranted by these data. As discussed earlier, a complex series of biometric tests and chemical analyses would be required to determine if any one individual has

Table 8. Percent of Sample Families in Three Nutrient Adequacy Levels by Program Participation Status, Bedford County

Nutrient	Percent Adequacy 1/	Wave I			Wave II			Wave III		
		CD	NCD	Diff. 2/	FS_1	NFS_1	Diff. 2/	FS_2	NFS_2	Diff. 2/
Energy	<67	24	24	0	33	40	-7	52	58	-6
	67-99	36	37	-1	31	29	+2	34	31	+3
	100+	40	39	1	36	30	+6	15	12	+3
Protein	<67	12	14	-2	13	17	-4	22	29	-7
	67-99	15	24	-9	15	20	-5	24	24	0
	100+	73	62	+11	72	63	+9	54	48	+6
Calcium	<67	45	43	+2	43	53	-10	65	73	-8
	67-99	29	28	+1	22	27	-5	24	17	+7
	100+	26	28	-2	35	20	+15	11	10	+1
Phosphorous	<67	14	11	+3	17	15	+2	29	30	-1
	67-99	19	24	-5	18	31	-13	24	35	-11
	100+	67	65	+2	65	54	+11	47	35	+12
Iron	<67	26	25	+1	27	29	-2	42	54	-12
	67-99	27	31	-4	38	39	-1	28	31	-3
	100+	47	44	+3	35	32	+3	30	15	+15
Vitamin A	<67	45	56	-11	54	49	+5	62	66	-4
	67-99	22	16	+6	15	19	-4	18	13	+5
	100+	33	28	+5	31	33	-2	20	21	-1
Thiamin	<67	23	24	-1	20	24	-4	38	52	-14
	67-99	27	29	-2	29	30	-1	22	23	-1
	100+	50	47	+3	51	46	+5	39	24	+15
Riboflavin	<67	20	20	0	20	28	-8	34	49	-15
	67-99	22	29	-7	22	22	0	19	23	-4
	100+	58	51	+7	58	50	+8	47	28	+19
Niacin	<67	27	23	+4	21	25	-4	37	46	-9
	67-99	18	27	-9	28	28	0	25	29	-4
	100+	55	49	+6	51	47	+4	38	26	14

Table 8. Continued

Nutrient	Percent Adequacy[1]	Wave I			Wave II			Wave III		
		CD	NCD	Diff.[2]	FS_1	NFS_1	Diff.[2]	FS_2	NFS_2	Diff.[2]
Vitamin C	<67	40	31	+9	17	12	+5	55	57	-2
	67-99	14	20	-6	17	12	+5	18	16	+2
	100+	46	49	-3	48	49	-1	27	27	0
MAR 100	<67	20	17	+3	20	24	-4	43	47	-4
	67-99	74	72	+2	71	67	+4	55	52	+3
	100+	6	12	-6	9	9	0	2	1	+1

[1] Family intake of selected nutrients as a percent of Required Dietary Allowance (RDA). See text for discussion of MAR.

[2] Participants minus nonparticipants.

a serious nutritional deficiency. Dietary intake is known to fluctuate from day to day, and many nutrients can be stored in the body, so that an inadequate intake on any given day is not serious, unless it is part of a consistent pattern of undernutrition. The 24-hour dietary recall is designed for group comparisons, not individual diagnosis. When one group is compared with another and is found to have a considerably lower 24-hour dietary intake (lower adequacy ratio on the average, or a greater incidence of reported intake below the dietary standard), this is evidence that families in this group are more likely to have serious deficiencies. One trouble with this kind of comparison, of course, is that other things (e.g., income, time since pay, family size, etc.) are generally not equal between groups being compared. Regression analysis (see the predicted $\hat{Y}$ values presented later) has the advantage of permitting estimates in which other things are held constant, so that the effects of certain factors such as program participation can be measured. Comparison of group averages can pinpoint problem areas, but cannot tell us why one group is better off than another; regression analysis gives insight into the underlying reasons.

CD participants and nonparticipants in Bedford County (NCD) both reported inadequate energy intake in one out of four families interviewed. Three months later, during Wave II, a somewhat higher proportion reported inadequate energy intake - one-third of FS_1 participants versus 40 percent of NFS_1 sample families. During Wave III, one year after Wave I, an even higher incidence of energy inadequacy was reported, but again the food program participants had proportionately fewer families in the inadequate range: 52 versus 58 percent.

The reason for this trend toward less adequate energy intake is not known. This pattern was not found consistently among the various nutrients. In most cases there was little or no change from one survey to the next, and in some cases the trend was toward an improved dietary intake.

For example, the incidence of inadequate Vitamin C intake dropped sharply (from 31 to 12 percent) among the program nonparticipants between Wave I (early Summer, 1969) and Wave II (Fall, 1969). Program participants showed a similar improvement: 40 percent of CD families consumed less than two-third of the RDA of Vitamin C, compared with 17 percent of FS_1 recipients.

The fact that there was a general improvement in adequacy of Vitamin C (among both participants and nonparticipants) could perhaps be explained partly by the increased supply of fresh fruits and vegetables in the fall, as gardens become mature and as the quality and prices of these items in grocery stores become more favorable. Families receiving CD had an average MAR of 82.6 - the same mean value as those receiving FS_1 during Wave II. Meanwhile the average MAR of nonparticipant families dropped slightly, from 82.3 to 78.3. Thus, according to these averages and the frequency distributions, it appears that participating families remained at about the same overall dietary level from Wave I to Wave II, and in the relative sense they become better off, as the diets of nonparticipants got somewhat worse. Many factors are not held constant in these comparisons, however, the questions are re-examined subsequently with multivariate analysis, and similar results were obtained.

Between Wave I and Wave III (June 1969 to June 1970) the incidence of inadequate Vitamin C intake increased substantially, both for program participants and nonparticipants. More than half of the FS_2 and NFS_2

families in Bedford County reported Vitamin C intake less than two-third of RDA in June 1970, Table 8. A similar deterioration was observed in all the other nutrients as well.

The trend in MAR is consistent with these changes. The average MAR declined from 83 to 67 among program participants (first CD, then FS_2); a slightly bigger decline was observed among nonparticipants, Table 7. The proportion of families with MAR values less than 67 also indicated a general deterioration of the diets. For example, 20 percent of CD sample families had MAR less than 67, compared with 43 percent of FS_2 families. An even greater increase was observed among nonparticipants: 17 and 47 percent. Thus, using the nonparticipants as a comparison group, it appears that the program participants had comparatively better diets, in the sense that their dietary intake deteriorated less during the year June 1969 to June 1970.

The surveys conducted in Huntingdon County revealed that the most serious nutrient inadequacy was in calcium. The average of the calcium adequacy ratios was 63 percent of RDA for the 24 families who recently received FS_1, Table 9. The averages for Vitamin A and energy (kilocalories) were 79 and 88, respectively, for this same group of families. All the other nutrients were reported at levels at or above 100 percent of RDA on the average. Nonparticipants had somewhat higher averages during these surveys, and, consistent with this, a lower proportion of families reporting inadequate intake of each nutrient, Table 10.

The average MAR values for participants and nonparticipants were similar during wave I, 71 and 73 for FS_1 and NFS_1, respectively, Table 9. During wave II, the average MAR values were higher: 81 versus 87

Table 9. Average MAR and Nutrient Adequacy Ratios for Ten Nutrients, for Families Receiving Food Assistance Within the Past 14 Days Versus Nonparticipants at the Same Location and Time, Huntingdon County.

Item	Wave I		Wave II	
	$FS_1 < 14$	Others	$FS_2 < 14$	Others
n	24	138	34	94
MAR	70.7	72.5	80.5	86.8
Energy	87.5	92.8	88.2	106.4
Prot.	125.0	131.2	129.4	152.1
Calc.	62.5	82.6	76.5	96.8
Phos.	120.8	129.7	123.5	144.7
Iron	104.2	100.0	100.0	117.0
Vit. A	79.2	92.0	82.4	90.4
Thia.	100.0	114.5	105.9	116.0
Ribo.	100.0	113.8	108.8	124.5
Nia.	116.7	118.1	114.7	130.9
Vit. C	116.7	131.2	94.1	110.6

Table 10. Percent of Sample Families in Three Nutrient Adequacy Levels by Program Participation Status, Huntingdon County

Nutrient	Percent Adequacy[1]	Wave I			Wave II		
		FS_1	NFS1	Diff.[2]	FS_2	NFS_2	Diff.[2]
Energy	<67	37	25	+12	25	21	+4
	67-99	26	40	-14	32	31	+1
	100+	37	35	+2	43	48	-5
Protein	<67	18	18	0	6	7	-1
	67-99	18	18	0	21	16	+5
	100+	63	54	-1	73	77	-4
Calcium	<67	55	40	+15	48	33	+15
	67-99	23	29	-6	25	28	-3
	100+	22	30	-8	27	39	-12
Phosphorous	<67	11	10	+1	6	9	-3
	67-99	27	19	+8	19	9	+10
	100+	62	71	-9	75	82	-7
Iron	<67	27	25	+2	22	19	+3
	67-99	28	28	0	32	26	+6
	100+	45	47	-2	46	55	-9
Vitamin A	<67	50	40	+10	56	45	+11
	67-99	15	27	-12	6	17	-11
	100+	35	33	+2	38	38	0
Thiamin	<67	28	15	+13	24	13	+11
	67-99	20	31	-11	24	34	-10
	100+	52	54	-2	52	53	-1
Riboflavin	<67	30	20	+10	22	15	+7
	67-99	25	28	-3	30	18	+12
	100+	45	52	-7	48	66	-18
Niacin	<67	20	14	+6	14	13	+1
	67-99	27	27	0	16	21	-5
	100+	53	59	-6	70	65	+5
Vitamin C	<67	30	22	+8	38	31	+7
	67-99	10	12	-2	13	18	-5
	100+	60	66	-6	49	51	-2
MAR 100	<67	23	15	+8	19	13	+6
	67-99	67	76	-9	68	73	-5
	100+	10	9	+1	13	13	0

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[1] Family intake of selected nutrients as a percent of Recommended Dietary Allowance (RDA). See text for discussion of MAR.

[2] Participants minus nonparticipants.

for FS_2 and NFS_2, respectively.

Thus, based on the results of these tabulations it would appear that the Food Stamp program did not enhance the diets of the Huntingdon County low-income families. However, as mentioned earlier, several important variables are not held constant, so that inferences may not be made as to program effectiveness on the basis of this information. Before turning to the multivariate analysis for a more incisive view of program effects, let us consider several important differences between program participants and non-participant groups of the survey families. Differences in characteristics such as family size, education and age of the homemaker, and family income all seem relevant to an analysis of the effects of food programs on dietary adequacy of the poor.

2. Other Characteristics of the Families

When the data from the five surveys were summarized into tables, it became clear that there was no strong and consistent pattern relating program participation to three other family characteristics: size of family, age and education of the head of household. The fact that these are apparently unrelated is an advantage, as far as the multivariate analysis (discussed later) is concerned; multicollinearity could be a problem otherwise.

3. Family Income and Frequency of Pay

The ratio of income to poverty threshold (INPO) was used in this study as an index of income adequacy. Nearly 9 out of 10 of the families interviewed in Bedford Wave I had incomes which for the month prior to the interview were below the poverty line (INPO< 100). This same proportion was found among both CD and NCD families. In subsequent surveys, a much lower percentage of nonparticipants was below the poverty line--about 70 to 80 percent in Waves II and III.

The fact that 10 to 15 percent of program participants in the sample reported incomes above the poverty line seems inconsistent with the eligibility rules. However, one main reason that could account for this apparent discrepancy is that the certifying social case worker may deduct a number of expenses such as those associated with work, medical care, etc., in determining eligibility.

In Huntingdon County, the proportion of nonparticipants below the poverty line dropped somewhat--from 65 to 56 percent--between Wave I and Wave II (August 1969 and November 1970). This could be the result of more poor families signing up for FS_2, plus an increase in income of others who were formerly below the poverty line and not using FS_1.

In examining the frequency of receiving income, it was found that program participants are more likely to be paid biweekly than otherwise. Likewise, nonparticipants are more likely to be paid monthly, weekly, or more often than weekly. This is partly a reflection of the fact that the welfare (DPA) checks are mailed out every two weeks, whereas social security checks (received mainly by the elderly) come only once a month.

F. MULTIVARIATE ANALYSIS

1. The Analytical Model for Multivariate Analysis

Since the primary objective of this study is to measure and test the effects of various independent variables--principally food aid program status--on dietary adequacy, statistical tools were selected which could utilize the available data most efficiently. Many important variables are not held constant in the tabulations presented earlier. Consequently, it is not possible to draw valid inferences about the effects of the program *per se* based solely on these results. In an attempt to adjust for the other variables so as to determine the effect of the program variable alone, multiple regression analysis of the data was done. This kind of analysis makes it possible to achieve some of the advantage of aggregating the data, (compensating errors) and at the same time analyze the relationships between dietary adequacy levels of individual households and their other characteristics and conditions. This method analyzes several independent or explanatory variables at once. That is, under the assumptions of the method, the effect of the program participation variable on the dependent variable is measured while the effects of all other independent variables in the equation are held constant. The model used for the regression equation permits the examination of the effect of both quantitative and qualitative factors on the dependent variable. Dummy variables were used to incorporate qualitative and discrete variables such as food assistance program status, and day of the week. Other variables that are naturally quantitative (such as income or days since pay) were coded both as a continuous and as a categorical variable, representing the latter with sets of dummy variables. This procedure is illustrated in detail below, along with the various equations and test statistics. The main conclusions drawn from the analysis are presented below.

In an attempt to explain the variation in the dependent variable, adequacy of dietary intake, several independent variables were selected for the regression equations. These variables are:

(1) number of persons in household (no.)

(2) education of the homemaker (years)

(3) age of the homemaker (years)

(4) her participation in the nutrition education program (coded as number of nutrition aide visits)

(5) ratio of current annual income to current poverty threshold. This variable is in real or price-adjusted terms, because the poverty thresholds are inflated each year by the amount of increase in the Consumer Price Index. (coded alternately as continuous variable and a categorical variable)

(6) whether or not any food was produced at home (1 = yes, 0 = otherwise)

(7) day of week (1 = Saturday or Sunday, 0 = otherwise)

(8) days since pay (days since the month's largest pay; coded as a categorical variable split at 14 days.)

(9) food program participation status (CD, FS_1, FS_2, or NFA--no food assistance)

(10) days since food assistance (CD or FS) was received. (coded as a continuous variable and as a categorical variable split at 14 days)

(11) amount of food assistance obtained per month (coded as dollars of monthly bonus per person)

(12) bonus per person per day since receipt of food assistance (formed as the ratio of item 11 divided by item 10)

(13) food expenditure per person per month (dollars)[13/]

(14) income frequency (coded as 1 if the family receives its pay once a month or less often, zero otherwise)

[13/] Based on a simple global question, how much did the family spend on food last month. While the data obtained in this way were not intended to accurately reflect the actual expenditure level for an individual family, it may provide adequate accuracy for the purposes of group comparison analysis presented here. Multicollinearity does not seem to have been critical between this variable and others, principally program status, as discussed later.

It would have been impractical to include the race variable since virtually all households in the sample--as in all of rural Pennsylvania--are white.

The conventional ordinary least squares multiple regression model (analysis of covariance), with continuous and discrete (dummy) variables, was used as the basis of the multivariate analysis. The residuals from an equation with MAR as dependent variable were analyzed with the Automatic Interaction Detector (AID) program, to test the additivity assumption inherent in the regression model--that the errors are distributed independently of the independent variables. The complex interaction terms implies by the AID results were entered as dummy variables in a subsequent regression. The F test for the contribution of these interaction terms was not significant at the 5 percent level. This finding was taken to mean that the original regression equations with simple 2-way interactions, as presented in this report, are essentially free of complex (3-way or higher order) interactions. Consequently, the complex interaction dummies were deleted in subsequent analysis.

Weighted regression was considered and discarded at an earlier stage of this study, because a serious bias is introduced through the use of weights. The bias stems from the fact that the weights vary with program participation status of the observation, so that the program effects are obscured when weighted regression is used. Therefore, the conventional unweighted regression techniques were used in this study.

Eleven different dietary adequacy equations were computed, one with MAR as dependent variable, and one with each of the 10 individual nutrient adequacy ratios as dependent variable. Results of these equations, as discussed below, led to other hypotheses calling for additional regressions using food expenditure and dietary efficiency as dependent variables.

2. Results of Multiple Regression Analysis

In interpreting the findings of the multiple regression analysis, 3 central questions are emphasized:

(1) How does program participation affect the overall dietary adequacy of the families?

(2) How is the adequacy of each nutrient affected? In cases where nutrient intake is increased, were the non-participating families deficient in these nutrients? Or is the increase redundant, adding to an already adequate quantity?

(3) How can the variations in dietary intake associated with the programs be best explained? How is program status related to food expenditure? Do program participants use their food dollar with greater nutritional efficiency than other low-income families?

a. Cross-sectional analysis of dietary adequacy data:

A large number of individual equations were estimated in this study. Those presented here seem to be the most relevant and reliable. When alternative equations involving different equation forms and interaction terms were computed, the findings with regard to effects of the food aid programs remained remarkably consistent. The equation featuring MAR as the dependent variable, equation 1.01, has been computed with and without the adjustment for bias due to percent of meals eaten away from home as discussed earlier, and the findings were essentially the same. The adjusted MAR is used here, because it seems conceptually and statistically more defensible than the original MAR. Equation 1.01 is discussed in detail, as a procedural guide to interpretation of the other equations, presented in Appendix B. Each of the equations 1.02 through 1.11 is like 1.01, except the dependent variable is an individual nutrient adequacy ratio, rather than MAR.

Whenever a nutrient adequacy ratio--for example, energy or kilocalories--is used as a dependent variable, the ratio is truncated at an upper value of 200 percent of RDA for that nutrient. That is, for each family that consumed more than twice their adjusted RDA of energy (calories), that family's energy adequacy ratio was set equal to 2. This method was adopted for the following reasons:

1. It is generally recognized that energy intake above the RDA does not contribute to "adequacy" of the diet; intake of twice the RDA or more could even be detrimental in the long run. The same is true of most other nutrients.
2. By truncating the ratios at a value of 2, the distribution of the ratios was made more nearly normal, and the variance was made much more uniform, thus reducing the likelihood of the statistical problem of heteroscedasticity. This feature also reduced the possibility of the results being greatly distorted by the overconsumption of a few families on the day covered by the interview.

In calculating the MAR, each of the 10 nutrient adequacy ratios was truncated at 100 percent of RDA before the average was calculated. This procedure was adopted to prevent over-consumption of one nutrient from obscuring underconsumption of another, as discussed earlier. This truncating procedure clearly introduces a form of heteroscedasticity, in that the MAR for that subset of families having the most adequate diets will have a lower variance than the families with less adequate diets. However, this statistical objection was over-ruled in favor of the nutritional considerations.

Equation 1.01 contains two types of explanatory variables, continuous and discrete, Table 11. The regression coefficient (b) of a continuous variable, such as age of the homemaker, measures what effect an increase of one unit of that explanatory variable has on the dependent variable. Thus, the average net effect of one more year of age on the MAR index was minus 0.09 percentage points--implying the family would have 3.6 percentage points (40 times 0.090) lower MAR if the homemaker was age 60 than if she was age 20, other things assumed to be equal. The regression coefficient (b_6) is significant in this case, since its t value (2.23) is greater than the tabulated value at the 5 percent level of probability. It should be noted, however, that despite the fact that this effect is significant in the statistical sense, it is still too small in magnitude to have any practical significance. A small difference in consumption of a nutritious food could have a much greater impact, as discussed earlier.

The regression coefficient of a dummy variable representing a qualitative or discrete variable, such as having home produced food, measures the net effect of a particular category as opposed to the category which was omitted or assigned the "0" value in that set of dummy variables. The positive effect on the MAR index of having home-produced food was 2.20 points (see b_4), significant at the 5 percent level.

Entire sets of variables were also tested for the significance of the extent to which they explain variation within the dependent variable, using Snedecor's F statistic. This is a test of the null hypothesis that the estimates of these parameters are all zero (6, pp. 10-11). For example, income turned out to be a significant variable ($F = 3.4$ for variables X_{40} and X_{41}; $p < .05$); families with income below the poverty

Table 11. EQUATION 1.01 MAR AS DEPENDENT VARIABLE (n = 1001)

Variable	i Variable Number	n_i Cell Count	b_i Regression Coefficient	s_{b_i} Standard Error	Relevant Student t Values	F Ratio
Education of Homemaker (years):	3	n	-0.035	0.062	0.56	
Age of Homemaker (years):	6	n	-0.090	0.040	2.23*	
Home Produced Food (1=yes):	4	523	2.431	1.106	2.20*	
(Omitted: No HPF)		478				
Size of Household:						3.16*
Size 3 - 4	23	261	1.819	1.649		
Size 5 - 6	24	231	5.176	1.885		
Size 7 +	25	202	4.617	1.915		
(Omitted: size < 3)		307				
Nutr. Aide Visits:[1/]						
N.A.V. 3 - 5	37	37	7.397	6.863		
N.A.V. 6 - 12	38	57	4.445	7.028		
N.A.V. 13 - 60	39	29	5.651	7.818		
(Omitted: N.A.V. < 3)		878				
Interactions:						
N.A.V. < 3; HFS < 15 days	33	32	19.085	12.192		
N.A.V. 3+; HFS < 15 days	34	24	10.185	14.185		
N.A.V. < 3; no F.S. or > 15 days	35	135	-0.489	7.801		
N.A.V. 3+; no F.S. or > 15 days	36	92	-6.600	10.340		
(Omitted: HFS 15 + days)		718				
Unit Vector (constant)	21	n	70.597	4.565		
Weekdays	22	932	-2.661	2.117	1.26	
(Omitted: Sat. and Sun.)		69				

[1/] These variables include observations in Huntingdon County only, since the Nutrition Education Program did not exist in Bedford County.

*$p < 0.05$
**$p < 0.01$

Table 11. (continued)

Variable	i Variable Number	n_i Cell Count	b_i Regression Coefficient	s_{b_i} Standard Error	Relevant Student t Values	F Ratio
Days Since Payday:						1.89
DSBP 15 + days	14	198	4.151	3.150		
DSBP Not rep.	15	89	-3.218	3.213		
(Omitted: DSBP < 15 days)		714				
Interactions:						0.94
DSBP < 15; CD < 15 days	8	39	1.713	10.378		
DSBP 15 +; CD < 15 days	9	24	-5.303	10.802		
DSBP < 15; FS < 15 days	10	151	-3.695	8.811		
DSBP 15; FS < 15 days	11	33	-3.089	9.372		
DSBP < 15; No F.A.	12	400	-2.223	2.958		
DSBP 15+; No F.A.	13	102	-7.107	3.861		
(Omitted: All DSFA 15+)		252				
Food Program Status:						9.91**
Huntingdon County:						
$DSFS_1$ < 15 days	16	24	-15.265	14.463		
No FS_1 or 15+ days	17	138	4.687	7.967		
$DSFS_2$ < 15 days	19	34	-3.074	14.479		
No FS_2 or 15+ days	20	94	19.248	7.636		
Bedford County:						
No CD	26	89	15.873	2.269		
No FS_1	27	112	11.492	2.094		
DSCD < 15 days	28	66	12.598	9.818		
DSCD 15+ days	29	97	10.993	2.936		
$DSFS_1$ < 15 days	30	67	15.411	8.641		
$DSFS_1$ 15+ days	31	36	7.158	3.714		
$DSFS_2$ < 15 days	32	64	5.369	8.776		
(Omitted No FS_2 Bedford)		157				
Income/Poverty Threshold:						3.41*
In/Po 1-1.25	40	90	1.224	1.903	0.64	
In/Po 1.26+	41	147	4.549	1.747	2.60**	
(Omitted In/Po < 1.0)		764				
Monthly Food Exp./person ($)	59	n	0.103	0.038	2.69**	
Income Frequency (1 = once or less per mo.)	61	253	-3.538	1.478	2.39**	

$R^2 = 0.194$

A.O.V. of regression: F = 6.101*

*$p < 0.05$
**$p < 0.01$

line (INPO 1.0) have at least[14] 4.5 points lower MAR, compared with families having incomes slightly above 125 percent of the poverty level ($t_{41} = 2.6$; $p < .01$).

Size of household was also found to be significant ($F = 3.16$; $p < .05$). Families of 5 or 6 persons have the best diets, other things being equal. This seems to be related to economies of family size. When monthly food expenditure per person is regressed on family size (et al) in equation 3.1, it was found that larger families spend less per person, assuming a given level of overall dietary adequacy. (This relationship is discussed in greater detail later.) Number of nutrition aide visits does not appear to be significantly related to the overall adequacy of dietary intake (MAR). The families seem to eat somewhat better on the weekends (b_{22} = 2.7 points of MAR) but this was not significant at the .20 level of probability.

Food expenditure is generally expected to be a very important determinant of dietary adequacy. As monthly food expenditure per person increases by a dollar, MAR increases by 0.1 points (see b_{59}). This is significant at the .01 level of probability. What is the interpretation of this food expenditure variable, in the context of equation 1.01, which features program participation variables? Is it not possible that food expenditure and program status are so highly correlated as to lead to distorted estimates of program effects? Apparently this is not the case, as evidenced by two kinds of information. First, a similar equation computed with all the same variables except with food expenditure omitted gives almost identically the same findings with regard to program effects. Second, when this food expenditure variable is regressed with program variables (et al) as independent variables, it appears that the effect of the food program status of the family on monthly food expenditure per person is usually not significant, as discussed later. Therefore, it would appear that the food expenditure coefficient can be interpreted as indicating how much the MAR will rise with an increase in food expenditure, other things (including program participation) assumed to be equal.

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[14] Actually the higher income families are estimated to have a slightly (0.35 points of MAR) larger advantage than indicated in the coefficient b_{41}, for the following reason. Their food expenditure is estimated at $3.54 higher per person per month (equation 3.1) and the effect of this through b_{59} in equation 1.01 is slight increase in MAR--3.54 times 0.10 equals 0.35 points higher MAR due to this effect.

Income frequency (X_{61}) was also found to be significantly related to dietary adequacy. Families who receive their income more often than once a month have 3.5 points higher MAR than families paid less frequently, other things being equal. The DPA (welfare) checks are mailed out every two weeks, but social security, retirement, some wages, and several other sources of income are typically paid only once a month. It is possible that the families who are paid more often than once a month are somehow "different" from the other low-income families, and that these other differences are the cause of their better diets. It is also possible that the obvious interpretation of the income frequency coefficient is correct--that frequent receipt of income, in and of itself, leads to improved dietary adequacy. Further research, including observed changes in income frequency, would be required to establish the causal relation with a greater degree of certainty.

The effects of the variables discussed above are easy to infer directly from the individual coefficients in equation 1.01. This direct approach is not permitted in the case of variables included in interaction terms, such as food program status and length of time since pay. Testing the effects of these variables must be done jointly, using comparisons of predicted values ($\hat{Y}$) representing various combinations of attributes. Alternatively (and equivalently) t tests of linear combinations of coefficients can be used to test the same relationships. Both methods are used here.

Table 12 contains the $\hat{Y}$ values for a simulated family with certain assumed characteristics, under a variety of different program/days since pay situations. The hypothetical household is a size 4 family, ($X_{23} = 1$) with home produced food ($X_4 = 1$). The homemaker is assumed to be age 40 ($X_6 = 40$) and to have a 10th grade education ($X_3 = 10$), and she is assumed not to participate in the nutrition aide program. Food expenditure per person per month is assumed as \$25.00 ($b_{59} = 25$); if \$15 had been assumed, for example, the MAR values would be reduced by 1 point (i.e. \$10 times b_{59}). The family is assumed to receive its income more often than once a month, and the income is arbitrarily set at a relatively low level, less than 100 percent of the poverty line; a family assumed to have income at 125 percent of the poverty line would have 4.5 points higher MAR, other things assumed equal. A weekday ($X_{22} = 1$) is assumed; on weekends the family would have 2.7 points higher MAR.

The top row of Table 12 indicates the predicted values ($\hat{Y}$) of MAR for the hypothetical family under the various programs assuming more than 14 days since pay. Subsequent rows show the analogous $\hat{Y}$ values from the 10 individual nutrient equations, 1.02 through 1.11. Table 13 is a similar table, but assuming less than 2 weeks since pay. Tables 14 and 15 are the counterparts of Tables 12 and 13, respectively, in that they contain the linear combinations and t statistics for testing the difference between families recently receiving food assistance (FS or CD within 2 weeks) versus nonparticipants and those who received food assistance more than 2 weeks prior to their interview.

ividual Nutrient Adequacy Ratios, by Program Participation
Regression Equations 1.01 to 1.11, Assuming Constant
an 14 Days Since Pay.

	Bedford County					Huntingdon County			
	Wave II			Wave III		Wave I		Wave II	
NCD	Days Since FS_1 1-14	Days Since FS_1 15-39	NFS_1	1-14 Days Since FS_2	NFS_2 and over 14 Days	1-14 Days Since FS_1	NFS_1 and over 14 Days	1-14 Days Since FS_2	NFS_2 and over 14 Days
83.7	87.3*	75.0	79.3	77.2*	67.9	75.7	72.1	87.9	86.6
01.8	103.5	79.5	91.7	84.9	68.8	97.1	90.1	101.1	103.5
32.7	151.2**	121.3	120.6	129.8 *	99.8	131.0	125.5	138.0	144.4
88.9	93.8	90.0	80.6	71.3	64.8	69.0	81.9	84.3	92.7
28.2	141.0*	121.1	118.7	116.2	95.2	123.0	120.8	131.2	133.0
94.4	103.5	58.4	85.9	96.4**	66.5	105.6	90.3	116.9	110.8
88.9	96.4	66.7	93.0	81.1	74.7	94.2	94.3	95.2	89.0
00.6	127.7**	85.1	91.5	105.3**	72.0	105.4	99.0	121.8	103.8
18.6	130.9	114.5	112.2	110.6*	87.1	107.1	113.3	118.4	121.7
08.7	128.2*	93.4	102.7	106.4	83.8	116.5	113.4	123.0	128.3
20.7	125.2	94.6	110.0	88.4	84.3	116.4	128.3	110.7	117.8

ipants at same location and time, at 5 percent level of probability.

ipants at same location and time, at 1 percent level of probability.

Table 12. Estimated Values of MAR and Individual Nutrient Adequacy Ratios, by Program Participation Status and by County, Based on Regression Equations 1.01 to 1.11, Assuming Constant Family Characteristics--More Than 14 Days Since Pay.

Dietary Adequacy Ratio	Bedford County								Huntingdon Coun	
	Wave I			Wave II			Wave III		Wave I	
	Days Since CD		NCD	Days Since FS_1		NFS_1	1-14 Days Since FS_2	NFS_2 and over 14 Days	1-14 Days Since FS_1	NFS_1 and over 14 Days
	1-14	15-39		1-14	15-39					
MAR	82.3	78.8	83.7	87.3*	75.0	79.3	77.2*	67.9	75.7	72.1
Energy	98.6	95.1	101.8	103.5	79.5	91.7	84.9	68.8	97.1	90.1
Protein	150.4	129.1	132.7	151.2**	121.3	120.6	129.8 *	99.8	131.0	125.5
Calcium	65.8*	89.0	88.9	93.8	90.0	80.6	71.3	64.8	69.0	81.9
Phosphorous	120.0	127.0	128.2	141.0*	121.1	118.7	116.2	95.2	123.0	120.8
Iron	96.8	80.4	94.4	103.5	58.4	85.9	96.4**	66.5	105.6	90.3
Vitamin A	81.8	78.6	88.9	96.4	66.7	93.0	81.1	74.7	94.2	94.3
Thiamin	106.2	93.1	100.6	127.7**	85.1	91.5	105.3**	72.0	105.4	99.0
Riboflavin	111.5	116.8	118.6	130.9	114.5	112.2	110.6*	87.1	107.1	113.3
Niacin	123.0	99.8	108.7	128.2*	93.4	102.7	106.4	83.8	116.5	113.4
Vitamin C	115.5	104.4	120.7	125.2	94.6	110.0	88.4	84.3	116.4	128.3

* Significantly different from nonparticipants at same location and time, at 5 percent level of probability.

** Significantly different from nonparticipants at same location and time, at 1 percent level of probability.

R and Individual Nutrient Adequacy Ratios, by Program
nd by County, Based on Regression Equations 1.01 to 1.11,
ly Characteristics--Less Than 15 Days Since Pay.

	Bedford County						Huntingdon County			
		Wave II			Wave III		Wave I		Wave II	
	NCD	Days Since FS_1		NFS_1	1-14 Days Since FS_2	NFS_2 and over 14 Days	1-14 Days Since FS_1	NFS_1 and over 14 Days	1-14 Days Since FS_2	NFS_2 and over 14 Days
9		1-14	15-39							
6	84.5	82.5	75.1	80.1	72.5	68.6	70.9	72.8	83.1	87.3
3	102.9	90.7	80.8	92.9	72.1	70.0	84.3	91.3	88.3	104.8
9	138.5	140.1	127.1	126.5	118.7	105.6	119.9	131.3	126.9*	150.2
7	87.6	84.7	88.8	79.4	62.2	63.7	59.8	80.7	75.1	91.5
2	134.4	130.6	127.3	125.0	105.8	101.5	112.6	127.0	120.9	139.2
2	98.2	84.7	62.2	89.6	77.6	70.3	86.9	94.0	98.2	114.6
0	86.3	91.5	64.3	90.6	76.2	72.2	89.3	91.9	90.3	86.5
1	113.6	114.0	98.1	104.4	91.6	84.9	91.7	111.9	108.1	116.7
0	117.9	118.8	113.9	111.5	98.5	86.5	95.0	112.7	106.3	121.0
7	109.6	115.8	94.2	103.6	94.1	84.6	104.1	114.2	110.7	129.2
4	120.7	117.0	94.8	110.2	80.2	84.4	108.2	128.4	102.5	117.9

FS_2, at 0.05 level of probability.

Table 13. Estimated Values of MAR and Individual Nutrient Adequacy Ratios, by Program Participation Status and by County, Based on Regression Equations 1.01 to 1.11, Assuming Constant Family Characteristics--Less Than 15 Days Since Pay.

Dietary Adequacy Ratio	Bedford County								Huntingdon Co	
	Wave I			Wave II			Wave III		Wave I	
	Days Since CD		NCD	Days Since FS_1		NFS_1	1-14 Days Since FS_2	NFS_2 and over 14 Days	1-14 Days Since FS_1	NFS_1 and over 14 Days
	1-14	15-39		1-14	15-39					
MAR	85.1	79.6	84.5	82.5	75.1	80.1	72.5	68.6	70.9	72.8
Energy	103.9	96.3	102.9	90.7	80.8	92.9	72.1	70.0	84.3	91.3
Protein	142.8	134.9	138.5	140.1	127.1	126.5	118.7	105.6	119.9	131.3
Calcium	89.1	87.7	87.6	84.7	88.8	79.4	62.2	63.7	59.8	80.7
Phosphorous	129.1	133.2	134.4	130.6	127.3	125.0	105.8	101.5	112.6	127.0
Iron	101.5	84.2	98.2	84.7	62.2	89.6	77.6	70.3	86.9	94.0
Vitamin A	102.1	76.0	86.3	91.5	64.3	90.6	76.2	72.2	89.3	91.9
Thiamin	104.2	106.1	113.6	114.0	98.1	104.4	91.6	84.9	91.7	111.9
Riboflavin	118.2	116.0	117.9	118.8	113.9	111.5	98.5	86.5	95.0	112.7
Niacin	103.5	100.7	109.6	115.8	94.2	103.6	94.1	84.6	104.1	114.2
Vitamin C	110.4	104.4	120.7	117.0	94.8	110.2	80.2	84.4	108.2	128.4

* Significantly lower value for FS_2, at 0.05 level of probability.

Table 14. Estimated Effects of Food Programs on MAR and Ten Individual Nutrient Adequacy Ratios Based on Equations 1.01 to 1.11 by Type of Program and County, For Families Receiving Food Assistance Recently (1-14 days)--Assuming More than 14 Days Since Pay.

Dietary Adequacy Ratio	Estimated amount by which program participants exceeded non participants at the same location and time (percentage points)				
	Bedford County			Huntingdon County	
	LD	FS_1	FS_2	FS_1	FS_2
MAR	-1.5 (0.36)	7.9 (2.06)*	9.4 (2.26)*	3.6 (0.66)	1.3 (0.24)
NUTRIENTS:					
ENERGY	-3.1 (0.32)	11.9 (1.30)	16.1 (1.63)	7.0 (0.53)	-2.5 (0.19)
PROTEIN	17.8 (1.51)	30.6 (2.76)**	30.0 (2.51)*	5.5 (0.35)	6.3 (0.42)
CALCIUM	-23.2 (2.20)*	13.2 (1.33)	6.5 (0.61)	-12.9 (0.90)	-8.4 (0.61)
PHOSPHOROUS	-8.2 (0.70)	22.3 (2.01)*	20.9 (1.75)	2.2 (0.14)	-1.8 (0.12)
IRON	2.4 (0.23)	17.6 (1.78)	29.8 (2.80)**	15.3 (1.08)	6.1 (0.45)
VITAMIN A	-7.1 (0.51)	3.3 (0.25)	6.4 (0.45)	-0.2 (0.01)	6.2 (0.35)
THIAMIN	5.7 (0.48)	36.3 (3.25)**	33.3 (2.77)**	6.5 (0.40)	18.0 (1.18)
RIBOFLAVIN	-7.1 (0.62)	18.7 (1.74)	23.4 (2.02)*	-6.3 (0.40)	-3.3 (0.22)
NIACIN	14.3 (1.17)	25.4 (2.21)*	22.6 (1.82)	3.1 (0.19)	-5.3 (0.34)
VITAMIN C	-5.2 (0.32)	15.2 (1.00)	4.1 (0.25)	-11.8 (0.54)	-7.1 (0.34)

( ) Numbers in parenthesis are t values.

* Significant at the 5 percent level.

** Significant at the 1 percent level.

Table 15. Estimated Effects of Food Programs on MAR and Ten Individual Nutrient Adequacy Ratios, (Based on equations 1.01 to 1.11) by Type of Program and County, For Families Receiving Food Assistance Recently (1-14 days) Assuming Less Than 15 Days Since Pay.

Dietary Adequacy Ratio	Estimated amount by which program participants exceeded nonparticipants at the same location and time (percentage points)				
	Bedford County			Huntingdon County	
	CD	FS_1	FS_2	FS_1	FS_2
MAR	0.7 (0.20)	2.4 (0.89)	3.9 (1.52)	-1.9 (0.39)	-4.2 (1.03)
NUTRIENTS:					
ENERGY	1.0 (0.12)	-2.1 (0.33)	2.1 (0.35)	-7.0 (0.62)	16.5 (1.69)
PROTEIN	4.3 (0.46)	13.7 (1.73)	13.1 (1.77)	-11.4 (0.83)	-23.3 (1.97)*
CALCIUM	1.3 (0.16)	-5.3 (0.74)	-1.5 (0.22)	-20.9 (1.69)	-16.3 (1.54)
PHOSPHOROUS	-5.3 (0.56)	5.7 (0.72)	4.4 (0.59)	-14.4 (1.05)	-18.3 (1.56)
IRON	3.3 (0.39)	-4.9 (0.70)	7.3 (1.12)	-7.2 (0.59)	-16.4 (1.56)
VITAMIN A	15.7 (1.41)	0.9 (0.09)	4.0 (0.46)	-2.6 (0.16)	3.7 (0.27)
THIAMIN	-9.4 (0.99)	9.6 (1.21)	6.7 (0.90)	-20.2 (1.46)	-8.6 (0.73)
RIBOFLAVIN	0.2 (0.02)	7.2 (0.94)	12.0 (1.69)	-17.7 (1.33)	-14.7 (1.29)
NIACIN	6.0 (0.62)	12.2 (1.49)	9.5 (1.23)	-10.1 (0.71)	-18.5 (1.51)
VITAMIN C	-10.4 (0.80)	6.9 (0.63)	4.2 (0.41)	-20.1 (1.07)	15.4 (0.95)

( ) Numbers in parenthesis are t values.

* Significant at the 5 percent level.

** Significant at the 1 percent level.

The $\hat{Y}$ values shown in Tables 12 and 13 are roughly the same magnitude as the $\bar{Y}$ (mean) values shown earlier in Table 7. The main advantage of the $\hat{Y}$ values is that other things are held constant (under the assumptions of the regression model) whereas this cannot be assumed in dealing with averages of observed data. For example, a hypothetical Bedford County family receiving FS_1 within 2 weeks of the interview would have an MAR of 87, Table 12. A similar family not using FS_1 at the same location and time (Fall 1969) would have an MAR of 79. The difference, 8 points, is significant at the .05 level, as shown in Table 14. This latter quantity was computed using a linear combination (LC) of the relevant variables ($LC = b_{11} + b_{30} - b_{13} - b_{27} = 7.94$; $t = 2.06$.) The differences between the various $\hat{Y}$ values were used as a check on the accuracy of the LC values, and vice versa. The same comparison using $\bar{Y}$ values, Table 7, shows difference of only about 4 points in MAR.

Comparison of Tables 12 and 13 clearly reveals that the dietary benefit of the CD and FS programs is definitely stronger late in the pay month--when more than 2 weeks has elapsed since receipt of income. In fact, no significant improvements in nutrient ratios or MAR are predicted for families that received their income within 2 weeks prior to their interviews.

How important are the dietary benefits of CD and FS for families who have not received income within the past 2 weeks? Several conclusions are apparent from Table 12. First, it is clear that some nutrients, notably protein, Vitamin C, phosphorus, and the three B vitamins (Thiamin, Riboflavin, and Niacin) are predicted to be consumed at levels consistently well above the deficiency line (2/3 of RDA) for program nonparticipants as well as those who do participate in the food programs. Any contribution of the programs toward higher levels of these nutrients would be of relatively little value, as compared with enhancement in nutrients consumed, at deficient levels. For example, in Bedford Wave II the hypothetical FS_1 family more than 14 days since pay is estimated to have significantly higher protein adequacy ratio than nonparticipants--151 versus 121, Table 12. This 30.6 point differential is statistically significant at the .01 level Table 14. However, one might raise doubts as to the nutritional significance of increasing protein further beyond an already adequate level. Similar improvements within the adequate range were predicted in other cases--phosphorus, thiamin, and niacin.

For an actual individual family, this would not be nutritionally desirable, particularly in some nutrients where an excess can be detrimental. In the present analytical context, the implications are less detrimental Recognizing that the findings relate to comparisons among groups of families, it is apparent that the higher the predicted value of a nutrient ratio for the "hypothetical family" representing that group, the less likely are members of that group to have diets deficient in that nutrient. Therefore, we should not completely discount the program benefits in the range way beyond the deficiency level. At the same time, it seems realistic to place greater emphasis upon improvements that bring families from the deficient range into a more adequate level.

For example, in Bedford Wave III, it was predicted that the hypothetical FS_2 family would have iron intake 96.4 percent of RDA, compared with 66.5 percent for a similar family not using food stamps (or having not bought FS_2 for more than 14 days.)[2/]

[2/] Nearly all of the sample respondents purchased FS_2 every two weeks. Consequently it was not statistically feasible to have a separate category for those families receiving FS_2 more than 2 weeks prior to the interview, because of inadequate cell count. Analysis of CD and FS_1 data from Bedford County supported our apriori suggestion, that these observations should be grouped with nonparticipants and families getting FS_2 more recently than 2 weeks should be treated separately. The same procedure was followed in coding the Huntingdon data.

A similar improvement in energy adequacy ratio (86 versus 69) was statistically significant at about the 10 percent level. The improvements in adequacy ratios for calcium (from 65 to 71) and Vitamin A (75 to 81) were not statistically significant; there is at least a 40 percent chance that differences this large could occur by random chance.

In the case of both FS_1 and FS_2 in Bedford County, the predicted MAR was significantly higher (at the .05 level) for participants than for nonparticipants. But CD recipients had a slightly lower predicted MAR than did NCD families (82 vs. 84; t = 0.36). The only statistically significant difference in individual nutrient ratios was calcium; CD families were predicted to have less adequate calcium intake than NCD families (66 vs. 89).

No significant differences in nutrient ratios were predicted between participants and nonparticipants in Huntingdon County, either with FS_1 or FS_2. In the case of some nutrients (iron, Vitamin A, and riboflavin, for example) participants exceeded nonparticipants slightly in both FS_1 and FS_2. In other nutrients the opposite was true. The MAR was slightly higher for participants in either program than for their respective comparison groups of nonparticipants. However, these differences are all so small in relation to their variance that they cannot be considered significant, and must be considered a chance occurrence. This lack of significance probably stems from the relatively small number of FS users in the Huntingdon County sample: 38 during Wave I, and 62 in Wave II. If a larger subsample were available, the results may have been quite different, and more statistically significant.

The nutritional adequacy of program participants declines sharply with increasing time since receipt of food aid. For example, the adequacy ratios for thiamin, riboflavin, and Vitamin C were all predicted at levels above 125 percent of RDA for Bedford FS_1 recipients during their first 14 days since getting the food stamps. In each of these cases the predicted ratios were below 95 percent of RDA when more that 2 weeks had elapsed since purchasing the food stamps. Similar differences were noted in other nutrients (e.g. iron and Vitamin A.) The predicted MAR drops sharply after 14 days since food stamps were purchased--from 87 to 75 ($p <.05$). A smaller decline--from 82 to 79--is predicted in the case of CD.

b. Changes in Dietary Adequacy As Families Changed Program Participation Status

Equations 1.01 through 1.11 tested the hypothesis that families on food assistance programs are nutritionally better off than nonparticipants by analyzing their MAR at various points in time. A somewhat different approach is used here.

Tracing the same families through time with the various surveys, it is possible to detect the impact of joining versus not joining a food program. For example, of the families who were on CD in 1969, did those who subsequently used food stamps have significantly better diets than those who dropped out? How did the dietary adequacy of these "dropout" families compare with that of the totally nonparticipating families--those who used neither CD nor FS?

These questions are quite important, in view of the fact that the majority of CD users drop out--fail to use FS. Thus, in assessing the change in overall dietary adequacy of the poor as a result of a change in program, it is not sufficient to look only at those who remained in the program. Those who drop out should be considered as well. And if their diets became considerably worse, one should question whether the county's decision to adopt the food stamp program yielded a net improvement in dietary well-being of the poor, at least in the short run. The effects of the recent revision in the cost of food stamps should also be considered; a large increase in participation occurred, and presumably some of the short run effects were overcome.

Two general types of independent variables were introduced into the equations as predictors of the change in MAR: (a) variables such as income and program status, which are likely to change in a way that could significantly affect the MAR, and (b) variables which are relatively stable but which may influence the family's ability to improve its diet, such as education of the homemaker, were introduced into the model as explanatory variables.

Equation 1.12 is based on the 241 families interviewed both in Wave I and Wave II in Bedford County--just before and just after the county switched from CD to FS, Table [illegible]. Four dummy variables were introduced to represent all possible changes in program status:

1. CD to FS_1 (96 families participated in both CD and FS_1.)
2. CD to NFS_1 (67 families "dropped out.")
3. NCD to FS_1 (21 families "joined" FS_1 who were not in CD.)
4. NCD to NFS_1 (57 families participated in neither programs.)

The latter group of 57 families remained nonparticipants. This was the comparison group, and the dummy variable representing this group was omitted from the regression equation.

Any change in MAR associated with seasonality or other exogenous factors would be reflected in the trend in MAR of the comparison group. In this way, the regression coefficients for the other program categories can be interpre[illegible] directly, as follows. The coefficient for CD to FS_1 (b_{81} = -2.165) indicates that the MAR of those CD families that joined FS_1 decreased slightly, as compared with the trend in the comparison group. However, this "relative change" in MAR was not significant (t = .70).

The CD families that dropped out (CD to NFS_1) had significantly worse diets: -8.0 relative change in MAR. Thus it appears that CD families were better off to have joined the FS_1 program than to have dropped out. A few (21) non-CD families joined FS_1; their diets were not significantly improved relative to other NCD families who did not begin using food stamps. Perhaps this result reflects indirectly some factors related to the dependency of CD families on food assistance.

Another relevant feature of equation 1.12 should be mentioned. Families with a high MAR level in Wave I (September 1969) were much less

Table 16. Equation 1.12, Change in MAR (Dependent Variable) from CD (June 1969) to FS_1 (September 1969), Bedford County, Pa. (n=241)

Variable		Cell	Regression	Standard	Student
Name	Number	Count	Coefficient	Error	t Values
Home Produced Food (Omitted No HPF)	9	122	1.930	2.448	.79
MAR (Sept. 1969)	15	n	-74.120	6.486	11.43**
Change in Size of HH	17	n	-1.360	2.113	.64
Change from Weekend to Weekday Meals (Omitted Weekday to Weekday)	33	26	0.974	3.702	.26
Unit Vector (Constant)	52	n	54.235	6.330	--
Education of Homemaker:					
6-8 Years	57	82	1.248	3.832	.33
9-11 Years	58	88	7.465	3.871	1.93
12+ Years (Omitted 0-5 Years)	59	42	9.223	4.318	2.14*
Income/Poverty Threshold:					
Change in In./Po.	19	n	0.017	0.027	0.61
In./Po. 1-1.25	91	14	4.233	4.964	.85
In./Po. 1.26+ (Omitted In./Po. 0-0.99)	92	16	6.304	4.829	1.31
Food Program Status:					
CD to FS_1	81	96	-2.165	3.077	0.70
CD to NFS_1	82	67	-8.021	3.235	2.48*
NCD to FS_1	83	21	0.591	4.599	0.13
(Omitted No Program to No Program)		57			

$R^2 = 0.387$
F = 10.23**

*$p < 0.05$
**$p < 0.01$

likely ($t = 11.43$) to have a big improvement in MAR between Wave I and Wave II.[1/] This is a reasonable result, given the fact that MAR is truncated at 100, so that a family with a high MAR initially could not possibly have a big increase subsequently. Also, this result probably reflects the fact that in many cases a low MAR in Wave I could have been a "fluke" due to exceptionally low dietary intake on the day covered by the interview.

Equation 1.13 is based on data from 234 families observed in Waves I and III (in June 1969 and June 1970) covering periods when Bedford County had CD and then FS_2, Table 17. Again the comparison group dummy variable representing nonparticipants (NCD to NFS_2) is omitted. In this case the findings are somewhat different, however. Joiners (NCD to FS_2) had a 14 point relative change in MAR ($t = 2.35$; $p < .05$), implying that their change in nutritional status during the year was significantly more favorable than that of the low income families that did not join the FS_2 program. Families that went from CD to FS_2 also had more favorable change in MAR than the comparison group (5.3 points), but this was statistically significant only at about the 10 percent level ($t = 1.58$), indicating there is more than a 1 in 10 chance that this large a change in MAR could occur due to chance rather than due to the program.

A comparison of the results of equations 1.12 and 1.13 indicates the change from CD to FS_2 had more favorable effects on the nutritional intake of the poor than did the change from CD to FS_1. Equation 1.14 yields

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[1/] A two-stage least squares regression model would have been preferable here, introducing the value of MAR predicted from equation 1, rather than the observed MAR, as the independent variable. This procedure would comply with the regression assumption that the independent variables are measured without error. It seems doubtful that the results would be greatly different using that method.

Table 17. Equation 1.13, Change in MAR (Dependent Variable) from CD (June 1969) to FS$_2$ (June 1970), Bedford County, Pa. (n=234).

Variable Name	Variable Number	Cell Count	Regression Coefficient	Standard Error	Student t Values
Home Produced Food	9	114	-3.637	2.568	1.42
(Omitted No HPF)					
MAR (June 1969)	15	n	-77.571	6.962	11.14**
Change in Size of HH	17	n	-0.858	1.860	0.46
Change from Weekend to Weekday Meals	33	26	-8.273	3.988	2.07*
Unit Vector (Constant)	52	n	46.972	6.667	--
Education of Homemaker:					
6-8 Years	57	83	0.669	4.091	0.16
9-11 Years	58	87	1.685	4.123	0.41
12+ Years	59	34	-1.178	4.928	0.24
(Omitted 0-5 Years)		28			
Income/Poverty Threshold:					
Change in In./Po.	19	n	0.035	0.029	1.19
In./Po. 1-1.25	91	12	0.036	5.796	0.01
In./Po. 1.26+	92	15	10.814	5.640	1.92
(Omitted In./Po. 0-0.99)		207			
Food Program Status:					
CD to FS$_2$	81	75	5.318	3.368	1.58
CD to NFS$_2$	82	82	3.481	3.175	1.10
NCD to FS$_2$	83	12	14.089	5.990	2.35*
(Omitted NCD to NFS$_2$)					

R^2 = 0.413

F = 11.06**

*$p < 0.05$

**$p < 0.01$

a somewhat similar conclusion, Table 18. Joiners (NFS_1 to FS_2) again showed an improvement, 9.5 points, which is significant at about the 5 percent level. Families who stayed in the FS program (FS_1 to FS_2) between September 1969 and the following June had a significantly more favorable change in MAR (6.7 points; $t = 1.97$, $p < .05$) than did the comparison group (NFS_1 to NFS_2). However, the findings are not entirely unequivocal, for dropouts (FS_1 to NFS_2) had a similar change in MAR--7.5 points. This is not significantly different from the change in MAR of those who stayed in the program, and it does not support the hypothesis that FS_2 is superior to FS_1. The reason for this result being out of line with the others is not known.

Equation 1.15 is similar to the preceding three equations, based on Huntingdon County data reflecting changes from Wave I and Wave II, Table 19. In this case, none of the program change categories is significant. Factors that seem most conducive to an improved MAR in these surveys are (a) a low initial MAR, (b) education beyond the 5th grade, and (c) relatively high initial income, above 125 percent of the poverty line during Wave I ($b_{92} = 13.4$; $p < .05$).

These findings are consistent with those of equation 1.01, which showed the FS program to be much less beneficial in Huntingdon than in Bedford County.

Differing results for both FS_1 and FS_2 in the two counties raised the question whether some influential factors unique to one county might be involved. Examination of a number of geographic characteristics such as topography, type of population and employment revealed no real difference. The counties are adjacent, both being predominately rural with a relatively high incidence of poverty. Reasons for these differences in program effects remain unclear at this point. The possibility that the Huntingdon County results are due to random variation should be recognized, however, in view of the fact that only 38 and 62 of the sample families were participating in FS during Waves I and II, respectively, Table 2.

Table 18. Equation 1.14, Change in MAR (Dependent Variable) from FS_1 (September 1969) to FS_2 (June 1970), Bedford County, Pa. (n=207).

Variable		Cell	Regression	Standard	Student
Name	Number	Count	Coefficient	Error	t Values
Home Produced Food	9	125	-0.443	2.954	.14
(Omitted No HPF)					
MAR (Sept. 1969)	15	n	-84.368	7.865	
Change in Size of HH	17	n	2.650	2.592	
Change from Weekend to Weekday Meals	33	10	-8.520	6.336	
(Omitted Weekday to Weekday)					
Unit Vector (Constant)	52	n	49.914	6.602	
Education of Homemaker:					
6-8 Years	57	69	1.216	4.315	
9-11 Years	58	77	-0.446	4.311	
12+ Years	59	33	-2.616	5.146	
(Omitted 0-5 Years)		26			
Income/Poverty Threshold:					
Change in In./Po.	19	n	0.005	0.032	0.15
In./Po. 1-1.25	91	22	4.873	4.638	1.05
In./Po. 1.26+	92	22	6.767	5.235	1.29
(Omitted In./Po. 0-0.99)					
Food Program Status:					
FS_1 to FS_2	81	62	6.674	3.394	1.97*
FS_1 to NFS_2	82	35	7.522	4.070	1.85
NFS_1 to FS_2	83	19	9.530	4.870	1.96
(Omitted NFS_1 to NFS_2)		91			

$R^2 = 0.439$
F = 10.78**

*$p < 0.05$
**$p < 0.01$

Table 19. Equation 1.15, Change in MAR (Dependent Variable) from FS_1 (August 1969) to FS_2 (November 1970), Huntingdon County, Pa. (n=157).

Variable		Cell	Regression	Standard	Student
Name	Number	Count	Coefficient	Error	t Values
Home Produced Food	9	120	5.563	2.981	1.87
(Omitted No HPF)		37			
MAR (Aug. 1969)	15	n	-86.539	6.757	12.81**
Change in Size of HH	17	n	1.625	1.535	1.06
Change from Weekend to Weekday Meals	33	9	- 0.244	5.297	0.05
(Omitted Weekday to Weekday)		148			
Unit Vector (Constant)	52	n	56.518	6.483	
Education of Homemaker:					
6-8 Years	57	72	11.718	4.307	2.67*
9-11 Years	58	38	10.078	4.890	2.06*
12+ Years	59	32	11.330	5.198	2.18*
(Omitted 0-5 Years)		15			
Income/Poverty Threshold:					
Change in In./Po.	19	n	0.008	0.025	0.33
In./Po. 1-1.25	91	13	1.194	4.484	0.27
In./Po. 1.26+	92	37	7.144	3.389	2.11*
(Omitted In./Po. 0-0.99)		107			
Food Program Status:					
FS_1 to FS_2	81	32	- 2.115	3.307	0.64
FS_1 to NFS_2	82	1	1.862	15.151	0.12
NFS_1 to FS_2	83	52	- 0.595	2.877	0.21
(Omitted NFS_1 to NFS_2)		72			

$R^2 = 0.558$ $\quad$ $^*p < 0.05$

$F = 12.92$ $\quad$ $^{**}p < 0.01$

c. Cost-Effectiveness and Nutritional Efficiency of the Programs

The various family food aid programs may be compared in terms of (a) relative attractiveness to potential participants, or (b) differences among those families who actually participate in one program versus another in terms of dietary and other characteristics. As noted earlier, participation has historically declined whenever CD was replaced by FS, but participation in the FS program increased sharply after the 1970 modifications became effective (FS_2). The purpose of the present section is to focus on a comparison of the programs in terms of their cost-effectiveness and nutritional efficiency, based on participating families.

Comparing families using FS_1 with those using FS_2, little if any difference in dietary benefit could be perceived. Yet the public cost of the FS_2 program is substantially higher, due to the reduced purchase price and larger bonus value for most families. Table 20 shows a comparison of the three food programs (CD, FS_1, and FS_2) under assumed conditions that would yield the highest level of dietary benefits and, consequently, the lowest cost per point of increase in MAR. The FS_1 program succeeded in raising the dietary adequacy of participating families at a cost of about 11¢ per point increase in MAR (ignoring administrative costs) in Bedford County; 22¢ in Huntingdon County. In contrast, the cost of raising the MAR by a point with FS_2 was 20¢ in Bedford County, and $1.04 in Huntingdon County.

Under less favorable conditions, the programs had an even higher cost-effectiveness ratio. For example, in Bedford County, when the families had received pay within the past two weeks, the dietary benefit from FS_2 was much smaller, and the cost per point proportionately higher, Table 21. The cost per point increase in MAR was 48¢, compared with 20¢ later in the pay month. Comparisons like those in Table 20 could not be made with reliability for the other food programs, because the denominator of the ratio (the increase in MAR) is so small and statistically non-significant. But the implication is clear: the cost-effectiveness ratios would be very high.

These cost-effectiveness data take on additional meaning when placed in perspective with the examples presented earlier in the discussion of the sensitivity of the MAR index. The cost per point of increase in MAR

Table 20. Cost-effectiveness of CD and FS programs in Bedford and Huntingdon Counties, Under Conditions With Highest Dietary Benefit of Programs.[1]

Program and County	Government Cost for a family of 4[2]	Increase in MAR	Cost per point increase in MAR
	dollars per day	percentage points	dollars per point
Bedford County			
CD	0.49	-1.5	[3]
FS_1	0.89	7.9	.11
FS_2	1.86	9.4	0.20
Huntingdon County			
FS_1	.78	3.6	.22
FS_2	1.35	1.3	1.04

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[1] More than 2 weeks since receipt of income, less than 2 weeks since receipt of food aid. If less favorable conditions were assumed, the cost per point would be higher than those shown here.

[2] The CD cost, based on the wholesale value of the foods distributed, is $14.72 per month for a family of 4. This understates the total public cost of the program. Total cost (of distribution and administration) to Federal and local governments was not presently available for either the CD or FS programs. The government cost for FS reflects the cost or average value of bonus stamps in that county at that time: \$26.68 and \$55.72 for FS_1 and FS_2, respectively, in Bedford County; \$23.52 and \$40.60 in Huntingdon County.

[3] Ratio not computed because the denominator is negative and nonsignificant.

was shown to be much lower--often less than 1¢ per point of MAR for families having very inadequate diets, when foods providing needed nutrients are added to the diet.

Table 21 Comparison of Cost Effectivesness Early vs. Late in the Pay Month, FS_2, Bedford County.

Time Since Pay	Government cost for a family of 4	Increase in MAR	Cost per point increase in MAR
	dollars per day	percentage points	dollars per point
More than 2 weeks	1.86	9.4	0.20
2 weeks or less	1.86	3.9	.48

This result suggests that CD and FS families, as well as the other poor families, are not getting optimum nutritional efficiency from their food resources. Perhaps foods are purchased that have little nutritional value, or that provide little of the nutrients most needed.

Analysis of the sample data bears out this point. An indication of the nutritional efficiency (NE) with which the food dollar (including FS) is used, we computed the ratio MAR per dollar food expenditure per person per month. This indicator was then used as a dependent variable in equation 2.1, Table 22. FS_2 users, during the first 2 weeks since receipt of income, had significantly lower predicted NE values than did their comparison group of nonparticipants, Table 23. This result supports the hypothesis that program participants do not use their food dollar as efficiently as other poor families, during the first several days after getting the food stamps. The same relationship was found with FS_1 users

TABLE 22. EQUATION 2.1. NUTRIENT EFFICIENCY (NE = MAR PER DOLLAR OF MONTHLY FOOD EXPENDITURE PER PERSON) AS DEPENDENT VARIABLE (n = 100) AS DEPENDENT VARIABLE (n = 1001).

Variable	i Variable Number	n_i Cell Count	b_i Regression Coefficient	s_{b_i} Standard Error	Relevant Student t Values	F Ratio
Education of Homemaker (years):	3	n	-0.002	0.010	0.22	
Age of Homemaker (years):	6	n	-0.014	0.006	2.29	
Home Produced Food (1=yes)	4	523	0.671	0.171	3.93	
(omitted: No HPF)		478				
Size of Household:						15.78
Size 3 - 4	23	261	0.544	0.251		
Size 5 - 6	24	231	1.242	0.286		
Size 7 +	25	202	1.848	0.285		
(omitted: size < 3)		307				
Nutr. Aide Visits:[1]						
N.A.V. 3 - 5	37	37	-0.143	1.063		
N.A.V. 6 - 12	38	57	-0.274	1.089		
N.A.V. 13 - 60	39	29	-0.461	1.211		
(omitted: N.A.V. < 3)		878				
Interactions:						
N.A.V. < 3; HFS < 15 days	33	32	1.037	1.888		
N.A.V. 3+; HFS < 15 days	34	24	1.034	2.196		
N.A.V. < 3; no F.S. or > 15 days	35	135	0.194	1.209		
N.A.V. 3+; no F.S. or > 15 days	36	92	-0.073	1.601		
(omitted: HFS 15 + days)		718				
Unit Vector (constant)	21	n	3.092	0.685		
Weekdays	22	932	-0.240	0.328	0.73	
(omitted: Sat. and Sun.)		69				

$^{*}p < 0.05$
$^{**}p < 0.01$

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[1] These variables include observations in Huntingdon County only, since the Nutrition Education Program did not exist in Bedford County.

Table. 22 (continued)

Variable	i Variable Number	n_i Cell Count	b_i Regression Coefficient	s_{b_i} Standard Error	Relevant Student t Values	F Ratio
Days Since Payday:						
DSBP 15 + days	14	198	0.666	0.485		
DSBP Not rep.	15	89	1.020	0.498		
(omitted: DSBP < 15 days)		714				
Interactions:						0.41
DSBP < 15; CD < 15 days	8	39	0.498	1.609		
DSBP 15 +; CD < 15 days	9	24	0.006	1.674		
DSBP < 15; FS < 15 days	10	151	1.087	1.364		
DSBP 15 +; FS < 15 days	11	33	0.545	1.452		
DSBP < 15; No F.A.	12	400	0.439	0.458		
DSBP 15 +; No. F.A.	13	102	-0.317	0.598		
(omitted: All DSFA 15+)		252				
Food Program Status:						4.76**
Huntingdon County:						
$DSFS_1$ < 15 days	16	24	-2.651	2.237		
No FS_1 or 15+ days	17	138	-0.449	1.235		
$DSFS_2$ < 15 days	19	34	-2.426	2.240		
No FS_2 or 15+ days	20	94	0.392	1.184		
Bedford County:						
No CD	26	89	0.960	0.351		
No FS_1	27	112	1.451	0.323		
DSCD < 15 days	28	66	0.835	1.522		
DSCD 15+ days	29	97	1.266	0.454		
$DSFS_1$ < 15 days	30	67	-0.205	1.339		
$DSFS_1$ 15+ days	31	36	0.080	0.575		
$DSFS_2$ < 15 days	32	64	-1.696	1.357		
(omitted No FS_2 Bedford)		157				
Income/Poverty Threshold:						3.62*
In/Po 1-1.25	40	90	-0.673	0.294	2.29*	
In/Po 1.26+	41	147	-0.480	0.268	1.79	
(omitted: In/Po < 1.0)		764				

R^2 = .19

A.O.V. of Regression: F = 6.28**

*$p < 0.05$

**$p < 0.01$

by Program Status and Days Since Pay; Estimated as Predicted
ation 2.1.

Bedford County							Huntingdon County			
e I		Wave II			Wave III		Wave I		Wave II	
	NCD	Days Since FS_1		NFS_1	1-14 Days Since FS_2	15-39 Days or NFS_2	1-14 Days Since FS_1	15-39 Days or NFS_1	1-14 Days Since FS_2	15-39 Days or NFS_2
-39		1-14	15-39							
.19	4.89	4.36	4.00	5.37	2.87	3.92	2.95	3.67	3.18	4.51
		(2.37)*			(2.65)**		(0.96)		(2.10)*	
.10	4.79	4.49	3.91	5.28	3.00	3.83	3.08	3.58	3.30	4.42
		(1.33)			(1.30)		(0.58)		(1.37)	

t tests for the difference between the NE of
espective comparison groups of nonpartici-
nt at 5 percent level; ** implies 1 percent

Table 23. Nutrient Efficiency by Program Status and Days Since Pay; Estimated as Predicted Values ($\hat{Y}$) from Equation 2.1.

Days Since Receiving Income	Bedford County								Huntingdon Cou		
	Wave I			Wave II			Wave III		Wave I		
	Days Since CD		NCD	Days Since FS_1		NFS_1	1-14 Days Since FS_2	15-39 Days or NFS_2	1-14 Days Since FS_1	15-39 Days or NFS_1	1-
	1-14	15-39		1-14	15-39						
1 - 14	4.81	5.19	4.89	4.36	4.00	5.37	2.87	3.92	2.95	3.67	
	(0.13)			(2.37)*			(2.65)**		(0.96)		(
15 +	4.99	5.10	4.79	4.49	3.91	5.28	3.00	3.83	3.08	3.58	
	(0.31)			(1.33)			(1.30)		(0.58)		(

( ) Numbers in parenthesis are t tests for the difference between the NE of participants versus their respective comparison groups of nonparticipants; * implies significant at 5 percent level; ** implies 1 percent level.

in Bedford County; but the difference between FS_1 and NFS_1 was not significant in Huntingdon County. Thus, the relationship is not uniform in all observed situations.

Recent CD recipients should be expected to have much higher NE values than NCD families, because of the free food. No difference was found, however. Both CD and NCD families were predicted to have the same MAR per food dollar per person per month.

Consistent with these results is the estimated effect of income on nutritional efficiency. Families below the poverty line have a significantly higher predicted NE value than do those with incomes from 100 to 125 percent of the poverty line ($t = 2.29$; $p < .05$).

All these findings support the "feast and famine" hypothesis -- that when food resources are plentiful, low-income families tend to get less nutritional value for their food dollar. This is no surprise, of course, since this relationship is widely known among higher income groups. Food provides utility in ways other than nutrition. Non-nutritional outputs include such things as (1) the pleasure associated with eating highly paletable foods, (2) the recreational value of a "vacation" from cooking through the use of convenience foods, and (3) the status-conferring aspect of preparing and serving special foods. The results presented above can be explained partly as a higher income elasticity of demand for the non-nutritional than for the nutritional outputs of food use.

When more than two weeks have elapsed since pay was received, the program participants begin to get more nutritional value from their food dollar. Consequently the difference in nutritional efficiency between participants and nonparticipants begins to fade. Differences significant at the 5 percent or lower level of probability during the first half of the pay month are now significant only at the 20 percent level.

d. Food Expenditure

If program participants have somewhat more adequate dietary intake, yet they have lower nutritional efficiency values (in terms of MAR per food dollar), then it stands to reason that participants must spend more for food than do nonparticipants. A regression equation was computed to test this hypothesis, equation 3.1 (Table 24). Monthly food expenditure per person is the dependent variable.

The relationship between family income and food expenditure in equation 3.1 turned out as expected: the higher the family income, the more is spent on food. Families with incomes somewhat greater than 125 percent of the poverty line spend significantly more on food than do families below the poverty line. And those families receiving income infrequently (one time or less per month) have somewhat lower food expenditure, though this is not statistically significant.

Food stamp users were predicted to have somewhat larger expenditures, other things being equal, Table 25. That is, at a given level of income, and with all other family characteristics held constant, families spend more on food per person. This implies that food stamp users have a somewhat higher average propensity to consume (APC), in view of the fact that food expenditures are higher at a given level of income.

Two precautions should be noted in interpreting this result. First the differences between participants and nonparticipants were not significant in most cases -- the only exception being Huntingdon FS_2, in which participants were predicted to spend about \$8 per person per month more on food than do the nonparticipants. The second precaution has to do with the dangers inherent in inferring causality from a self-stratifying sample. Do food stamp users have a higher APC for food because they are in the program? Or did they join the program because they have a higher

Table . 24 EQUATION 3.1 MONTHLY FOOD EXPENDITURE PER PERSON AS DEPENDENT VARIABLE, (n=1001)

Variable	i Variable Number	n_i Cell Count	b_i Regression Coefficient	s_{b_i} Standard Error	Relevant Student t Values	F Ratio
Education of Homemaker (years):	3	n	- 0.142	0.053	0.27	
Age of Homemaker (years):	6	n	0.051	0.034	1.50	
Home Produced Food: (1=yes):	4	523	- 1.295	0.930	1.39	
(omitted: No HPF)		478				
Size of Household:						16.38**
Size 3 - 4	23	261	- 3.048	1.386		
Size 5 - 6	24	231	- 7.806	1.568		
Size 7 +	25	202	- 9.720	1.583		
(omitted: size < 3)		307				
Nutr. Aide Visits:[1/]						
N.A.V. 3 - 5	37	37	- 2.845	5.780		
N.A.V. 6 -12	38	57	- 3.021	5.919		
N.A.V. 13 - 60	39	29	- 0.239	6.585		
(omitted: N.A.V. < 3)		878				
Interactions:						
N.A.V. < 3; HFS < 15 days	33	32	2.571	10.270		
N.A.V. 3+; HFS < 15 days	34	24	0.766	11.949		
N.A.V. < 3; no F.S. or > 15 days	35	135	- 0.545	6.572		
N.A.V. 3+; no F.S. or > 15 days	36	92	5.829	8.708		
(omitted: HFS 15 + days)		718				
Unit Vector (constant)	21	n	29.220	3.728		
Weekdays	22	932	0.350	1.783		
(omitted: Sat. and Sun.)		69				

*$p < 0.05$
**$p < 0.01$

[1/] These variables include observations in Huntingdon County only, since the Nutrition Education Program did not exist in Bedford County.

Table 24 (continued)

Variable	i Variable Number	n_i Cell Count	b_i Regression Coefficient	s_{b_i} Standard Error	Relevant Student t Values	F Ratio
Days Since Payday:						
DSBP 15+ days	14	198	- 0.926	2.654		
DSBP Not rep.	15	89	- 3.187	2.705		
(omitted: DSBP <15 days)		714				
Interactions:						0.16
DSBP <15; CD <15 days	8	39	- 0.604	8.742		
DSBP 15+; CD <15 days	9	24	2.064	9.099		
DSBP <15; FS <15 days	10	151	- 6.713	7.419		
DSBP 15+; FS <15 days	11	33	- 6.663	7.892		
DSBP <15; No F.A.	12	400	- 1.099	2.491		
DSBP 15+; No F.A.	13	102	- 0.876	3.252		
(omitted: All DSFA 15+)		252				
Food Program Status:						
Huntingdon County:						2.05
$DSFS_1$ <15 days	16	24	7.969	12.180		
No FS_1 or 15+ days	17	138	0.523	6.711		
$DSFS_2$ <15 days	19	34	10.800	12.192		
No FS_2 or 15+ days	20	94	0.025	6.432		
Bedford County:						
No CD	26	89	- 2.933	1.909		
No FS_1	27	112	- 4.431	1.758		
DSCD <15 days	28	66	- 2.848	8.270		
DSCD 15+ days	29	97	- 4.812	2.469		
$DSFS_1$ < 15 days	30	67	4.193	7.278		
$DSFS_1$ 15+ days	31	36	- 2.012	3.128		
$DSFS_2$ <15 days	32	64	9.581	7.386		
(omitted No FS_2 Bedford)		157				
Income/Poverty Threshold:						2.42
In/Po 1-1.25	40	90	1.245	1.602	0.78	
In/Po 1.26+	41	147	3.545	1.467	2.42*	
(omitted In/Po <1.0)		764				

$R^2 = 0.136$
$F = 4.118$**

*$p < 0.05$
**$p < 0.01$

APC? It could be that only that portion of the poor population which places higher emphasis on food would bother to sign up for food stamps. If so, then the dietary adequacy (or at least the food expenditure) of food stamp users would naturally exceed that of non-users. This question of possible bias is raised but cannot be answered rigorously on the basis of data available in this study. However, the data do not contain any indication of self-statification bias.

Table 25. Estimated Monthly Food Expenditure per Person, by Program Participation and Days Since Pay, Assuming Constant Household Characteristics (from equation 3.1).

Program Participation Status and Survey	Days Since Pay	
	1-14	15+
	dollars	dollars
Bedford County		
Wave I		
CD, 1-14 days	23.67	21.29
CD, 15-39 days	21.44	20.51
NCD	23.32	22.39
Wave II		
FS_1 1-14 days	24.60	23.73
FS_1 15-39 days	24.01	23.31
NFS_1	21.59	20.89
Wave III		
FS_2 1-14 days	29.99	29.12
FS_2 15-39 or NFS_2	26.03	25.32
Huntingdon County		
Wave I		
FS_1 1-14 days	30.95	30.08
NFS_1 15-39 or NFS_1	26.00	25.30
Wave II		
FS_2 1-14 days	33.78	32.91
NFS_2 15-39 days or NFS_2	25.51	24.80

G. PROCEDURAL SUMMARY

The findings of this analysis are summarized in the first part of this report, so the summary will not be repeated here. However, a few comments on statistical procedure may be useful.

Multivariate analysis has been done to facilitate comparison of food program participants versus nonparticipants under various assumptions, while holding other factors constant. A number of different regression equations were computed, to test program effects on each of 10 nutrients as well as the overall index of nutritional well-being (MAR). Food Stamps were associated with higher levels of nutritional adequacy in certain situations. The nutritional efficiency with which the sample respondents use their food dollar was also investigated using multiple regression equation, with a model similar to that used to explain nutritional adequacy variables. Food expenditure relationships with program status and other variables were also analyzed in a regression equation.

Comparisons between participants and nonparticipants were made on the basis of predicted values $(\hat{Y})$ from the regression equation, or equivalently, using linear combinations of variables crucial to the comparison. The significance of difference was tested using the student t test on the linear combinations. The significance of the overall regression model was tested with an F test. In each case, the regression was significant, even though the R^2 values were only around 20 percent. All the regressions reported here are unweighted. That is, each observation was treated the same, despite the fact that differential sampling rates were used in order to obtain enough program participants. This is the approach usually taken in studies of this kind. When weighted regression was tried, it was found that the results were unduly vulnerable to the variation in weight values for various subsamples, particularly certain program participants. It appeared that the results from weighted regression would be seriously biased in this manner. Therefore, it was the judgment of the authors that conventional unweighted regression (ordinary least-squares, analysis of covariance multiple regression) should be used.

The data were analyzed both in cross sectional form and longitudinally, in first differences. In the latter equations, change in nutritional adequacy was regressed against change in program status, income, and other variables. Results obtained from this method were consistent with those from the cross sectional approach.

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APPENDIX A

RECORDING THE 24-HOUR DIETARY RECALL

A. Purpose

The purpose is to obtain a record of food and beverage consumed by the household members during the 24 hours previous to the interview. The data will be processed to provide a record of the nutrient intake of the household. The respondent is the person responsible for the household's food preparation.

B. Instructions to Enumerators

The 24-hour dietary recall is taken on the entire household. It is not necessary to allocate amounts consumed to specific individuals. Neither is it necessary to secure and record information on meals prepared or eaten outside of the home. It is important to remember that the total amount consumed and not amount prepared should be recorded. Be sure to indicate in the "description" column whether or not the food contained refuse, e.g., unpeeled potatoes, meat with bone, etc. In helping the respondent recall amounts, keep in mind that pets may consume significant amounts of leftover food. Amount of leftover subtracted from amount prepared may not be amount consumed by the household. Keep this in mind where there are pets.

It is necessary to remind the respondent that you are interested in the past 24 hours' intake not in what usually is consumed. During the interview it will be helpful to use various household members' names in probing intake such as, "Did Johnnie have anything to eat or drink when he came home from school yesterday?"

When taking the recall it is usually easier for the respondent to give the menu or name of the dishes eaten and then afterward tell ingredients which were used to make the dish. Stopping for details of the recipe becomes confusing to many respondents.

It is necessary to record accurately whether an item is RAW or COOKED so that the appropriate code number can be assigned. At the end of the recall you may find it helpful to read it back and ask if there was anything forgotten, candy, cocktails, etc.

Note at top of page if faddism, serious feeding problems, drastic deviations from normal, etc. were observed.

C. Models for Estimating Quantities of Food

Food models designed for food intake surveys are common. However, the models designed for the National Nutrition Survey were unique in that they were designed in conjunction with a program for data processing by an electronic computer. These models and the principles of this data processing program were adopted for this study with some modifications.

Nutritionists and dietitians are familiar with more conventional survey methods which consist of (1) collecting dietary information and recording it in household portions then (2) converting the household portion to gram weights so that (3) nutrient values may be determined. The conversion of intake to gram weights is necessary because most tables of nutrient values are based on gram weight of foods.

For this study, the Nutrient Intake Tabulator Evaluator Program (NITE) was designed to determine the nutrient values of food consumed. The program processing the data is based on a food composition table which includes the 2,483 food items appearing in U. S. Department of Agriculture Handbook No. 8 (1963), Table No. 1, plus additional foods as needed to comply with other foods which respondents reported. The food table lists nutrients based on the amount of each nutrient in 100 grams of the specific food item.

The models have been designed to assist interviewers in securing from the respondent the amounts of food consumed. They have also been designed so that the computer can take the alphabetic code assigned to each model, make necessary mathematical computations based on the size of the model and arrive at (1) the grams of a food consumed then (2) the nutrients from the amount of food consumed. An oversimplified explanation of what will occur is demonstrated by the following example:

1. A respondent may answer: "My family ate applesauce in the amount of twice model 'S' this noon."
    a. The interviewer will record as follows:

Food Code 9-12	Food Item	I 14-19	II 20-24
0029	Applesauce	2	S

    b. The computer will determine the gram weight of applesauce based on the food code numbers recorded in Columns 9-12, and convert model "S" to 3/4 cup and make necessary calculations.

2. The respondent may have answered: "My family consumed spaghetti in the amount of twice model 'S' this noon."

a. The interviewer will record as follows:

Food Code 9-12	Food Item	I 14-19	II 20-24
2159	Spaghetti	2	S

b. The computer determines the gram weight and nutrient values for spaghetti using the food code number for spaghetti. It will then make necessary calculations to get nutrient values for this different item although measured with the same model.

Thus, the correct use of these models will eliminate the tedious, time-consuming procedures of converting each household measure to the gram weight. It is necessary that data be recorded in a specific and consistent way. Therefore, each interviewer must be thoroughly familiar with the portion size models and the appropriate method of using them.

Three basic principles should be noted:

1. All food items may be recorded by weight measure (i.e., oz., lb., or gm.).
2. Food items which generally are recorded by volume measure are recorded by models or household measures listed on pages 106 and 107.
3. Food items which are generally served in natural or conventional size units such as eggs, slices of bread, and raw fruits are based on a reference weight for a unit of that item. These must be recorded as "UNIT" or by weight measure but never by models or volume.

Now-- let us examine the model kit. It is important to understand that the models are not intended to be models of any one food. Rather, they are models designed to assess volume or amount.

These are the models and the alphabetic codes accepted by the computer program.

Model	Type Measure	Alphabetic Code	Numeric Equivalent (Equal to the number of 1/8 cups)	Approximate Household Measurement Equivalent
Cups	Cup	A	10.00	1 1/4 cups
		S	06.00	3/4 cup
Glasses	Cup	B	11.00	1 3/8 cups
		V	09.00	1 1/8 cups
		Q	05.00	5/8 cup
Spoons	Cup	SS	00.70	1 1/2 tbls.
		CC	00.50	1 tbls.
		M	00.30	1/2 tbls.
		E	00.20	1 tsp.
Mounds	Cup	C	16.00	2 cups
		S	06.00	3/4 cup
		Z	02.50	1/3 cup
		J	14.00	1 3/4 cups
		S	06.00	3/4 cup
		Z	02.50	1/3 cup
Bottles/cans	Cup	A	10.00	1 1/4 cups
		W	12.00	1 1/2 cups
		C	16.00	2 cups
		W	12.00	1 1/2 cups
		A	10.00	1 1/4 cups
		S	06.00	3/4 cup
Meat Mounds	Cup	H	01.50	3 tbls.
		Y	03.00	3/8 cup
		S	06.00	3/4 cup
		C	16.00	2 cups
		U	31.00	4 cups
French Bread	Unit	UNIT		34 gms.
Butter/Margarine pat	Cup	E	00.20	1 tsp.
Pie	Cup	D	04.00	1/2 cup
		Q	05.00	5/8 cup

Model	Type Measure	Alphabetic Code	Numeric Equivalent	Approximate Household Measurement Equivalent
Discs[1]	Cup	E	00.20	1 tsp.
		M	00.30	1/2 tbls.
		CC	00.50	1 tbls.
		MM	00.60	1 1/4 tbls.
		G	01.00	2 tbls.
		H	01.50	3 tbls.
Boxes	Cup	A	10	1 1/4 cups
		.35A	3.5	1/2 cup
		0.5C	07.5	1 cup

Other standard measurements and the abbreviation codes accepted by the computer program are:

Gram	GM
Ounce	OZ
Pint	PT
Quart	QT
Pound	LB
Cup	CUP
Unit	UNIT

These abbreviations and the model alphabetic codes are the only acceptable ways that foods may be recorded. Do not use a period after the abbreviation.

Reported intake will not always correspond to the exact size of the model. Detailed, specific rules for recording intake appear in part D. However, some general rules specifically related to the models are:

1. Glasses (B, V, Q) Marks are placed at the 1/4, 1/2, and 3/4 volume level. The top mark shows the full volume of the glass as

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[1] Unlike all other models, the discs do not demonstrate thickness or depth. YOU MUST USE THE RULER PROVIDED AND RECORD THE THICKNESS (see page 108 item 3).

it is considered by the computer. Example: Glass Model B at the full level mark is 1 3/8 cups, not if it is full "to the brim."

2. Meat (C, U) Lines appear on the sides of these models. They represent 1/4, 1/2, 3/4 and 4/4 of the thickness. These lines will be needed should the respondent state amount consumed was different thickness from the model.
3. Ruler for Discs - This model is to assist with dimensions or with disc models should thickness of the food consumed--as estimated by the disc--be other than 1/8 inch. The three-inch ruler is marked in inches and also 1/8 inch units. Along the side marked with inches, there are 1/4, 1/2, and also 3/4 inch markings. Note that a "2" is by the 1/4 inch marking. This implies 2 units of 1/8 inch, since the disc is based on 1/8 inch thickness.
4. Boxes - These models are for use in estimating quantities of foods usually served in these dimensions, such as cakes, pies, etc.

D. RECORDING AND CODING THE 24-HOUR FOOD INTAKE

This section is reproduced below for easy referral:
(Numbers in parentheses refer to columns for card punching.)

Ingestion Period Code	Food Codes				Food and Beverage Consumed		Number and Size of Servings			Bone or other refuse included? 1 = yes
							I	II	III	
(8)	(9)	(10)	(11)	(12)	Food Item	Description	(14-19)	(20-24)	(25-30)	(31)

Step 1: Ingestion Period

Record ingestion period code each time you move to a different meal.

1 = AM (breakfast)
2 = Noon (lunch)
3 = Between Meals
4 = PM (dinner or supper)

Step 2: The enumerator (interviewer) skips this item. The 4 digit food code (from USDA Handbook 8) for each food item is inserted later by a specially trained person.

Step 3: Food Item and Description Column

Record in these columns the exact food or beverage consumed.

a. Name of item

b. Description (raw, dry, frozen edible portion or as purchased)

c. Preparation method (fried, broiled)

d. Major ingredients (if a mixed dish)

Step 4: Work Area for Computations (if needed)

Use work area to enter any necessary information to describe the item and the probable amount if the specific amount cannot be entered in Item I immediately. For example, the food item is reported to be the size of several different models; time consuming calculation can be left until later--or--respondent cannot estimate size by one of the "acceptable models," necessitating additional later calculations.

Step 5: Size of Serving (Items I, II, and III)

These items determine the basis on which the nutrient intakes are calculated.

a. Item I under size of serving

This column is to be used to record the number of units or portion of a unit consumed. This shall always be a numeric entry. The numbers recorded here may be integers or decimal fractions.

Examples: 1 (Integer)

0.50 (Decimal Fraction)

Coding the recorded numeric entry

(1) All integers must be recorded with a trailing decimal.

Example: 1.0

(2) All decimal fractions must be recorded with leading zero and decimal point clearly marked.

Example: 0.50

b. Item II Under size of serving

This space is used to record the model letter code or abbreviation code which describes the measure of the food item consumed. This should always be an alphabetic entry. The possible acceptable entries are:

MODEL CODES

A, S	(Cups)
B, V, Q	(Glasses)
SS, CC, M, E	(Spoons)
C, S, Z, J	(Mounds)
A, W, C, S	(Bottles/cans)
H, S, C, U, Y	(Meat Mounds)
E	(Butter)
D, Q	(Pie)
E, M, G, H, CC, MM	(Discs)

ABBREVIATION CODES

GM = grams
OZ = ounce
PT = pints
QT = quarts
LB = pounds

OTHER CODES

CUP
UNIT

Examples of data which may be recorded in Item II:

RESPONSE	RECORD
Serving was rice model Z	Z
Serving was one apple	UNIT

c. Item III under size of serving

This space is used to modify the number of units or portion of a unit consumed which was recorded in Items I and II. In general, Item III is not used frequently. If respondent changes answer, rather than erasing in either Item I or II, use Item III for modifications.

(1) Amount prepared to amount consumed (left-over).

Respondent indicates that 5 pound beef roast was put on table but half of it (50%) was not consumed. Modifications to be recorded in Item III:

0.50 for 1/2 the amount, etc.

(2) Thickness of disc model is greater than 1/8 inch.

If respondent indicates the thickness was 1/2 inch thick or "4" on the ruler, record 4 in Item III.

(3) Household serving to individual amount when models are not applicable.

Respondent states that about 1/2 of the beef stew prepared for the household unit was eaten: Total prepared was 1 QT. Record: 0.5 under Item III.

(4) When the food item contains some refuse (e.g. meat with the bone in, apple core and seeds, etc.), a "1" is written in the far right column of the table. This code directs the program to automatically reduce the amounts by the percent of refuse given in Handbook 8, Table 2.

APPENDIX B.

EQUATIONS (1.02 to 1.11) WITH NUTRIENT ADEQUACY RATIOS AS DEPENDENT VARIABLE

Table B1. EQUATION 1.02; ENERGY ADEQUACY RATIO AS DEPENDENT VARIABLE, (n

Variable	i Variable Number	n_i Cell Count	b_i Regression Coefficient	s_{b_i} Standard Error	Relevant Student t Values	F Ratio
Education of Homemaker (years):	3	n	-0.001	0.001	0.451	
Age of Homemaker (years):	6	n	-0.002	0.001	1.750	
Home Produced Food (1=yes):	4	523	0.029	0.026	1.117	
(omitted: No HPF)		478				
Size of Household:						0.38
Size 3 - 4	23	261	0.027	0.039		
Size 5 - 6	24	231	0.042	0.045		
Size 7 +	25	202	0.046	0.046		
(omitted: size < 3)		307				
Nutr. Aide Visits:[1/]						
N.A.V. 3 - 5	37	37	0.292	0.164		
N.A.V. 6 -12	38	57	0.194	0.168		
N.A.V. 13-60	39	29	0.252	0.187		
(omitted: N.A.V. < 3)		878				
Interactions:						
N.A.V. < 3; HFS < 15 days	33	32	0.291	0.291		
N.A.V. 3+; HFS < 15 days	34	24	0.111	0.338		
N.A.V. < 3; no F.S. or ≥15 days	35	135	0.145	0.186		
N.A.V. 3+; no F.S. or ≥15 days	36	92	-0.018	0.247		
(omitted: HFS 15 + days)		718				
Unit Vector (constant)	21	n	0.819	0.109		
Weekdays	22	932	-0.095	0.050	1.877	
(omitted: Sat. and Sun.)		69				

[1/] These variables include observations in Huntingdon County only, since the Nutrition Education Program did not exist in Bedford County.

$*p < 0.05$
$**p < 0.01$

Table B1. (continued)

Variable	i Variable Number	n_i Cell Count	b_i Regression Coefficient	s_{b_i} Standard Error	Relevant Student t Values	F Ratio
Days Since Payday:						
DSBP 15 + days	14	198	0.106	0.075		
DSBP Not rep.	15	89	-0.035	0.077		
(omitted: DSBP < 15 days)		714				
Interactions:						1.00
DSBP < 15; CD < 15 days	8	39	0.120	0.248		
DSBP 15 +; CD < 15 days	9	24	-0.039	0.258		
DSBP < 15; FS < 15 days	10	151	-0.077	0.210		
DSBP 15 +; FS < 15 days	11	33	-0.055	0.224		
DSBP < 15; No F.A.	12	400	-0.051	0.071		
DSBP 15+; No F.A.	13	102	-0.170	0.092		
(omitted: All DSFA 15+)		252				
Food Program Status:						4.69**
Huntingdon County:						
DSFS$_1$ < 15 days	16	24	-0.123	0.345		
No FS$_1$ or 15+ days	17	138	0.068	0.190		
DSFS2 < 15 days	19	34	-0.083	0.345		
No FS$_2$ or 15+ days	20	94	0.202	0.182		
Bedford County:						
No CD	26	89	0.330	0.054		
No FS$_1$	27	112	0.229	0.050		
DSCD < 15 days	28	66	0.168	0.234		
DSCD 15+ days	29	97	0.263	0.070		
DSFS$_1$ < 15 days	30	67	0.233	0.206		
DSFS$_1$ 15+ days	31	36	0.108	0.089		
DSFS$_2$ < 15 days	32	64	0.047	0.209		
(omitted No FS$_2$ Bedford)		157				
Income/Poverty Threshold:						1.72
In/Po 1-1.25	40	90	-0.002	0.045	0.041	
In/Po 1.26+	41	147	0.076	0.042	1.820	
(omitted In/Po < 1.0)		764				
Monthly Food Exp/Person	59	n	0.002	0.001	1.961	
Income Frequency (1=once or less/mo.)	61	253	-0.087	0.035	2.462*	

$R^2 = 0.141$
F = 4.168

*$p < 0.05$
**$p \leq 0.01$

Table B2. EQUATION 1.03; PROTEIN ADEQUACY RATIO AS DEPENDENT VARIABLE,

Variable	i Variable Number	n_i Cell Count	b_i Regression Coefficient	s_{b_i} Standard Error	Relevant Student t Values	F Ratio
Education of Homemaker (years):	3	n	0.000	0.002	0.010	
Age of Homemaker (years):	6	n	-0.005	0.001	4.246**	
Home Produced Food (1=yes):	4	523	0.028	0.032	0.862	
(omitted: No HPF)		478				
Size of Household:						5.21**
Size 3 - 4	23	261	0.097	0.048		
Size 5 - 6	24	231	0.201	0.054		
Size 7 +	25	202	0.181	0.055		
(omitted: size<3)		307				
Nutr. Aide Visits:[1/]						
N.A.V. 3 - 5	37	37	0.490	0.198		
N.A.V. 6 -12	38	57	0.287	0.203		
N.A.V. 13-60	39	29	0.402	0.226		
(omitted: N.A.V.<3)		878				
Interactions:						
N.A.V.<3; HFS <15 days	33	32	0.431	0.352		
N.A.V. 3+; HFS <15 days	34	24	0.176	0.409		
N.A.V.<3; no F.S. or >15 days	35	135	-0.062	0.225		
N.A.V. 3+; no F.S. or >15 days	36	92	-0.408	0.298		
(omitted: HFS 15 + days)		718				
Unit Vector (constant)	21	n	1.249	0.132		
Weekdays	22	932	-0.168	0.061	2.758**	
(omitted: Sat. and Sun.)		69				

[1/] These variables include observations in Huntingdon County only, since the Nutrition Education Program did not exist in Bedford County.

* $p < 0.05$
** $p < 0.01$

Table B2. (continued)

Variable	i Variable Number	n_i Cell Count	b_i Regression Coefficient	s_{b_i} Standard Error	Relevant Student t Values	F Ratio
Days Since Payday:						
DSBP 15 + days	14	198	0.100	0.091		
DSBP Not rep.	15	89	-0.010	0.093		
(omitted: DSBP < 15 days)		714				
Interactions:						.90
DSBP < 15; CD < 15 days	8	39	-0.007	0.300		
DSBP 15 +; CD < 15 days	9	24	-0.030	0.312		
DSBP < 15; FS < 15 days	10	151	0.122	0.254		
DSBP 15 +; FS < 15 days	11	33	0.133	0.270		
DSBP < 15; No F.A.	12	400	-0.035	0.085		
DSBP 15+; No F.A.	13	102	-0.193	0.111		
(omitted: All DSFA 15+)		252				
Food Program Status:						4.18**
Huntingdon County:						
$DSFS_1$ < 15 days	16	24	-0.445	0.417		
No FS1 or 15+ days	17	138	0.319	0.230		
$DSFS_2$ < 15 days	19	34	-0.375	0.418		
No FS_2 or 15+ days	20	94	0.508	0.220		
Bedford County:						
No CD	26	89	0.328	0.065		
No FS_1	27	112	0.208	0.060		
DSCD < 15 days	28	66	0.344	0.283		
DSCD 15+ days	29	97	0.293	0.085		
$DSFS_1$ < 15 days	30	67	0.188	0.249		
$DSFS_1$ 15+ days	31	36	0.215	0.107		
$DSFS_2$ < 15 days	32	64	-0.026	0.253		
(omitted No FS_2 Bedford)		157				
Income/Poverty Threshold:						4.54*
In/Po 1-1.25	40	90	0.015	0.055	0.274	
In/Po 1.26+	41	147	0.151	0.050	3.002**	
(omitted In/Po < 1.0)		764				
Monthly Food Exp/Person ($)	59	n	0.003	0.001	3.034**	
Income Frequency (1=once or less/mo.)	61	253	-0.118	0.043	2.773**	

R^2 = 0.233 *$p < 0.05$

F = 7.706** **$p < 0.01$

Table B3. EQUATION 1.04; CALCIUM ADEQUACY RATIO AS DEPENDENT VARIABLE, ($n=1001$)

Variable	i Variable Number	n_i Cell Count	b_i Regression Coefficient	s_{b_i} Standard Error	Relevant Student t Values	F Ratio
Education of Homemaker (years):	3	n	-0.001	0.002	0.522	
Age of Homemaker (years):	6	n	-0.002	0.001	1.815	
Home Produced Food (1=yes):	4	523	0.004	0.029	0.155	
(omitted: No HPF)		478				
Size of Household:						0.44
Size 3 - 4	23	261	0.046	0.043		
Size 5 - 6	24	231	0.039	0.049		
Size 7 +	25	202	0.048	0.050		
(omitted: size< 3)		307				
Nutr. Aide Visits:[1]						
N.A.V. 3 - 5	37	37	0.388	0.178		
N.A.V. 6 -12	38	57	0.322	0.182		
N.A.V. 13-60	39	29	0.426	0.202		
(omitted: N.A.V. < 3)		878				
Interactions:						
N.A.V. < 3; HFS <15 days	33	32	0.298	0.316		
N.A.V. 3+; HFS <15 days	34	24	0.022	0.367		
N.A.V. < 3; no F.S. or >15 days	35	135	0.129	0.202		
N.A.V. 3+; no F.S. or >15 days	36	92	-0.123	0.268		
(omitted: HFS 15 + days)		718				
Unit Vector (constant)	21	n	0.637	0.118		
Weekdays	22	932	-0.080	0.055	.462	
(omitted: Sat. and Sun.)		69				

[1] These variables include observations in Huntingdon County only, since the Nutrition Education Program did not exist in Bedford County.

*$p < 0.05$
**$p < 0.01$

Table B3. (continued)

Variable	i Variable Number	n_i Cell Count	b_i Regression Coefficient	s_{b_i} Standard Error	Relevant Student t Values	F Ratio
Days Since Payday:						
DSBP 15 + days	14	198	0.161	0.082		
DSBP Not rep.	15	89	0.033	0.083		
(omitted: DSBP< 15 days)		714				
Interactions:						1.66
DSBP<15; CD <15 days	8	39	0.338	0.269		
DSBP 15 +; CD< 15 days	9	24	-0.057	0.280		
DSBP< 15; FS <15 days	10	151	-0.063	0.228		
DSBP 15 +; FS< 15 days	11	33	-0.132	0.243		
DSBP< 15; No F.A.	12	400	0.079	0.077		
DSBP 15+; No F.A.	13	102	-0.071	0.100		
(omitted: All DSFA 15+)		252				
Food Program Status:						3.26**
Huntingdon County:						
DSFS$_1$< 15 days	16	24	-0.195	0.375		
No FS$_1$ or 15+ days	17	138	0.041	0.206		
DSFS$_2$ <15 days	19	34	-0.042	0.375		
No FS$_2$ or 15+ days	20	94	0.149	0.198		
Bedford County:						
No CD	26	89	0.241	0.059		
No FS$_1$	27	112	0.158	0.054		
DSCD< 15 days	28	66	-0.005	0.254		
DSCD 15+ days	29	97	0.242	0.076		
DSFS$_1$< 15 days	30	67	0.352	0.224		
DSFS$_1$ 15+ days	31	36	0.252	0.096		
DSFS$_2$ <15 days	32	64	0.127	0.227		
(omitted No FS$_2$ Bedford)		157				
Income/Poverty Threshold:						3.35*
In/Po 1-1.25	40	90	-0.013	0.049	0.258	
In/Po 1.26+	41	147	0.113	0.045	2.489*	
(omitted In/Po< 1.0)		764				
Monthly Food Exp./Person ($)	59	n	0.001	0.001	1.401	
Income Frequency (1=once or less/mo.)	61	253	-0.085	0.038	2.208*	

$R^2 = 0.126$ *p < 0.05
F = 3.660** **p < 0.01

Table B4. EQUATION 1.05; PHOSPHORUS ADEQUACY RATIO AS DEPENDENT VARIABLE (N=1001)

Variable	i Variable Number	n_i Cell Count	b_i Regression Coefficient	s_{b_i} Standard Error	Relevant Student t Values	F Ratio
Education of Homemaker (years):	3	n	-0.000	0.002	0.125	
Age of Homemaker (years):	6	n	-0.002	0.001	2.029*	
Home Produced Food (1=yes):	4	523	0.030	0.032	0.942	
(omitted: No HPF)		478				
Size of Household:						0.28
Size 3 - 4	23	261	-0.010	0.047		
Size 5 - 6	24	231	-0.008	0.054		
Size 7 +	25	202	-0.043	0.055		
(omitted: size < 3)		307				
Nutr. Aide Visits:[1/]						
N.A.V. 3 - 5	37	37	0.435	0.197		
N.A.V. 6 -12	38	57	0.196	0.202		
N.A.V. 13-60	39	29	0.348	0.225		
(omitted: N.A.V. < 3)		878				
Interactions:						
N.A.V. < 3; HFS < 15 days	33	32	0.364	0.351		
N.A.V. 3+; HFS < 15 days	34	24	0.199	0.408		
N.A.V. < 3; no F.S. or > 15 days	35	135	-0.138	0.224		
N.A.V. 3+; no F.S. or > 15 days	36	92	-0.349	0.297		
(omitted: HFS 15 + days)		718				
Unit Vector (constant)	21	n	1.115	0.131		
Weekdays	22	932	-0.158	0.061	2.601**	
(omitted: Sat. and Sun.)		69				

[1/] These variables include observations in Huntingdon County only, since the Nutrition Education Program did not exist in Bedford County.

$*p < 0.05$
$**p < 0.01$

Table B4. (continued)

Variable	i Variable Number	n_i Cell Count	b_i Regression Coefficient	s_{b_i} Standard Error	Relevant Student t Values	F Ratio
Days Since Payday:						
DSBP 15 + days	14	198	0.178	0.091		
DSBP Not rep.	15	89	0.070	0.092		
(omitted: DSBP$<$15 days)		714				
Interactions:						1.17
DSBP$<$15; CD$<$15 days	8	39	0.111	0.299		
DSBP 15 +; CD$<$15 days	9	24	-0.158	0.311		
DSBP$<$15; FS$<$15 days	10	151	-0.021	0.253		
DSBP 15 +; FS$<$15 days	11	33	-0.096	0.270		
DSBP$<$15; No F.A.	12	400	0.059	0.085		
DSBP 15+; No F.A.	13	102	-0.181	0.111		
(omitted: All DSFA 15+)		252				
Food Program Status:						4.38**
Huntingdon County:						
DS$FS_1$$<$15 days	16	24	-0.172	0.416		
No FS_1 or 15+ days	17	138	0.393	0.229		
DS$FS_2$$<$15 days	19	34	-0.090	0.417		
No FS_2 or 15+ days	20	94	0.515	0.220		
Bedford County:						
No CD	26	89	0.330	0.065		
No FS_1	27	112	0.235	0.060		
DSCD$<$15 days	28	66	0.225	0.282		
DSCD 15+ days	29	97	0.317	0.084		
DS$FS_1$$<$15 days	30	67	0.372	0.249		
DSFS_1 15+ days	31	36	0.258	0.107		
DS$FS_2$$<$15 days	32	64	0.124	0.252		
(omitted No FS_2 Bedford)		157				
Income/Poverty Threshold:						3.02*
In/Po 1-1.25	40	90	0.023	0.055	0.425	
In/Po 1.26+	41	147	0.124	0.050	2.459*	
(omitted In/Po$<$1.0)		764				
Monthly Food Exp./Person ($)	59	n	0.003	0.001	2.737**	
Income Frequency (1=once or less/mo.)	61	253	-0.101	0.043	2.376*	

$R^2 = 0.142$ *$p < 0.05$

$F = 4.120$ **$p < 0.01$

Table B5. EQUATION 1.06; IRON ADEQUACY RATIO AS DEPENDENT VARIABLE, ($n=1001$)

Variable	i Variable Number	n_i Cell Count	b_i Regression Coefficient	s_{b_i} Standard Error	Relevant Student t Values	F Ratio
Education of Homemaker (years):	3	n	-0.001	0.002	0.791	
Age of Homemaker (years):	6	n	0.003	0.001	2.814**	
Home Produced Food (1=yes):	4	523	0.096	0.028	3.371**	
(omitted: No HPF)		478				
Size of Household:						1.02
Size 3 - 4	23	261	-0.058	0.042		
Size 5 - 6	24	231	-0.023	0.048		
Size 7 +	25	202	0.003	0.049		
(omitted: size<3)		307				
Nutr. Aide Visits:[1/]						
N.A.V. 3 - 5	37	37	0.312	0.176		
N.A.V. 6 -12	38	57	-0.003	0.180		
N,A.V. 13-60	39	29	0.140	0.201		
(omitted: N.A.V.<3)		878				
Interactions:						
N.A.V.<3; HFS<15 days	33	32	0.435	0.313		
N.A.V. 3+; HFS≤ 15 days	34	24	0.355	0.364		
N.A.V.<3; no F.S. or >15 days	35	135	-0.317	0.200		
N.A.V. 3+; no F.S. or >15 days	36	92	-0.456	0.265		
(omitted: HFS 15 + days)		718				
Unit Vector (constant)	21	n	0.761	0.117		
Weekdays	22	932	-0.100	0.054	1.837	
(omitted: Sat. and Sun.)		69				

[1/] These variables include observations in Huntingdon County only, since the Nutrition Education Program did not exist in Bedford County.

*$p < 0.05$
**$p < 0.01$

Table B5. (continued)

Variable	i Variable Number	n_i Cell Count	b_i Regression Coefficient	s_{b_i} Standard Error	Relevant Student t Values	F Ratio
Days Since Payday:						
DSBP 15 + days	14	198	0.080	0.081		
DSBP Not rep.	15	89	-0.113	0.082		
(omitted: DSBP $<$ 15 days)		714				
Interactions:						2.48*
DSBP $<$ 15; CD $<$ 15 days	8	39	-0.005	0.266		
DSBP 15 +; CD $<$ 15 days	9	24	-0.131	0.277		
DSBP $<$ 15; FS $<$ 15 days	10	151	-0.150	0.226		
DSBP 15 +; FS $<$ 15 days	11	33	-0.043	0.241		
DSBP $<$ 15; No F.A.	12	400	-0.178	0.076		
DSBP 15+; No F.A.	13	102	-0.297	0.099		
(omitted: All DSFA 15+)		252				
Food Program Status:						4.54**
Huntingdon County:						
DSFS$_1$ $<$ 15 days	16	24	-0.297	0.371		
No FS$_1$ or 15+ days	17	138	0.555	0.205		
DSFS$_2$ $<$ 15 days	19	34	-0.183	0.372		
No FS$_2$ or 15+ days	20	94	0.760	0.196		
Bedford County:						
No CD	26	89	0.279	0.058		
No FS$_1$	27	112	0.194	0.054		
DSCD $<$ 15 days	28	66	0.138	0.252		
DSCD 15+ days	29	97	0.139	0.075		
DSFS$_1$ $<$ 15 days	30	67	0.116	0.222		
DSFS$_1$ 15+ days	31	36	-0.081	0.095		
DSFS$_2$ $<$ 15 days	32	64	0.045	0.225		
(omitted No FS$_2$ Bedford)		157				
Income/Poverty Threshold:						2.26
In/Po 1-1.25	40	90	0.048	0.049	0.974	
In/Po 1.26+	41	147	0.091	0.045	2.030*	
(omitted In/Po $<$ 1.0)		764				
Monthly Food Exp./Person ($)	59	n	0.003	0.001	3.204**	
Income Frequency (1=once or less/mo.)	61	253	-0.078	0.038	2.050*	

$R^2 = 0.149$

F = 4.42**

*$p < 0.05$

**$p < 0.01$

Table B6. EQUATION 1.07; VITAMIN A ADEQUACY RATIO AS DEPENDENT
001

Variable	i Variable Number	n_i Cell Count	b_i Regression Coefficient	s_{b_i} Standard Error	Relevant Student t Values	F Ratio
Education of Homemaker (years):	3	n	-0.001	0.002	0.555	
Age of Homemaker (years):	6	n	-0.004	0.001	2.854**	
Home Produced Food (1=yes):	4	523	0.094	0.038	2.515*	
(omitted: No HPF)		478				
Size of Household:						0.90
Size 3 - 4	23	261	-0.024	0.056		
Size 5 - 6	24	231	0.023	0.064		
Size 7 +	25	202	0.067	0.065		
(omitted: size< 3)		307				
Nutr. Aide Visits:[1/]						
N.A.V. 3 - 5	37	37	0.346	0.233		
N.A.V. 6 - 12	38	57	0.382	0.239		
N.A.V. 13-60	39	29	0.628	0.265		
(omitted: N.A.V.< 3)		878				
Interactions:						
N.A.V.<3; HFS<15 days	33	32	0.586	0.414		
N.A.V. 3+; HFS<15 days	34	24	0.126	0.482		
N.A.V.< 3; no F.S. or>15 days	35	135	-0.472	0.265		
N.A.V. 3+; no F.S. or>15 days	36	92	-0.834	0.351		
(omitted: HFS 15 + days)		718				
Unit Vector (constant)	21	n	0.919	0.155		
Weekdays	22	932	0.016	0.072	0.216	
(omitted: Sat. and Sun.)		69				

[1/] These variables include observations in Huntingdon County only, since the Nutrition Education Program did not exist in Bedford County.

*$p < 0.05$
**$p < 0.01$

Table B6. (continued)

Variable	i Variable Number	n_i Cell Count	b_i Regression Coefficient	s_{b_i} Standard Error	Relevant Student t Values	F Ratio
Days Since Payday:						
DSBP 15 + days	14	198	0.059	0.107		
DSBP Not rep.	15	89	-0.070	0.109		
(omitted: DSBP$<$ 15 days)		714				
Interactions:						1.17
DSBP$<$ 15; CD$<$15 days	8	39	0.352	0.352		
DSBP 15 +; CD$<$15 days	9	24	0.089	0.367		
DSBP$<$ 15; FS $<$15 days	10	151	0.011	0.299		
DSBP 15 +; FS$<$15 days	11	33	0.000	0.318		
DSBP$<$15; No F.A.	12	400	-0.151	0.100		
DSBP 15+; No F.A.	13	102	-0.186	0.131		
(omitted: All DSFA 15+)		252				
Food Program Status:						1.76
Huntingdon County:						
DSFS$_1$$<$15 days	16	24	-0.577	0.491		
No FS$_1$ or 15+ days	17	138	0.669	0.270		
DSFS$_2$$<$15 days	19	34	-0.567	0.492		
No FS$_2$ or 15+ days	20	94	0.615	0.259		
Bedford County:						
No CD	26	89	0.142	0.077		
No FS$_1$	27	112	0.184	0.071		
DSCD$<$15 days	28	66	-0.204	0.333		
DSCD 15+ days	29	97	0.039	0.100		
DSFS$_1$$<$15 days	30	67	0.031	0.293		
DSFS$_1$ 15+ days	31	36	-0.079	0.126		
DSFS$_2$$<$15 days	32	64	-0.122	0.298		
(omitted No FS$_2$ Bedford)		157				
Income/Poverty Threshold:						3.27**
In/Po 1-1.25	40	90	-0.143	0.065	2.207*	
In/Po 1.26+	41	147	0.052	0.059	0.879	
(omitted In/Po$<$1.0)		764				
Monthly Food Exp./Person	59	n	0.001	0.001	1.104	
Income Frequency (1=once or less/mo.)	61	253	-0.061	0.050	1.207	

$R^2 = 0.080$
$F = 2.205$

*$p < 0.05$
**$p < 0.01$

Table B7. EQUATION 1.08; THIAMIN ADEQUACY RATIO AS DEPENDENT VARIABLE, (n=1001)

Variable	i Variable Number	n_i Cell Count	b_i Regression Coefficient	s_{b_i} Standard Error	Relevant Student t Values	F Ratio
Education of Homemaker (years):	3	n	-0.002	0.002	1.102	
Age of Homemaker (years):	6	n	-0.003	0.001	2.363*	
Home Produced Food (1=yes):	4	523	0.053	0.032	1.665	
(omitted: No HPF)		478				
Size of Household:						2.07
Size 3 - 4	23	261	0.030	0.048		
Size 5 - 6	24	231	0.106	0.055		
Size 7 +	25	202	0.115	0.056		
(omitted: size $<$ 3)		307				
Nutr. Aide Visits:[1/]						
N.A.V. 3 - 5	37	37	0.350	0.199		
N.A.V. 6 -12	38	57	0.075	0.204		
N.A.V. 13-60	39	29	0.078	0.227		
(omitted: N.A.V. $<$ 3)		878				
Interactions:						
N.A.V. $<$ 3; HFS $<$ 15 days	33	32	0.453	0.354		
N.A.V. 3+; HFS $<$ 15 days	34	24	0.289	0.412		
N.A.V. $<$ 3; no F.S. or $>$ 15 days	35	135	-0.115	0.227		
N.A.V. 3+; no F.S. or $>$ 15 days	36	92	-0.198	0.300		
(omitted: HFS 15 + days)		718				
Unit Vector (constant)	21	n	0.950	0.133		
Weekdays	22	932	-0.092	0.061	1.504	
(omitted: Sat. and Sun.)		69				

[1/] These variables include observations in Huntingdon County only, since the Nutrition Education Program did not exist in Bedford County.

*$p < 0.05$
**$p < 0.01$

Table B7. (continued)

Variable	i Variable Number	n_i Cell Count	b_i Regression Coefficient	s_{b_i} Standard Error	Relevant Student t Values	F Ratio
Days Since Payday:						
DSBP 15 + days	14	198	0.086	0.091		
DSBP Not rep.	15	89	0.020	0.093		
(omitted: DSBP $<$15 days)		714				
Interactions:						1.57
DSBP$<$ 15; CD$<$15 days	8	39	-0.200	0.301		
DSBP 15 +; CD$<$15 days	9	24	-0.265	0.314		
DSBP$<$15; FS $<$15 days	10	151	-0.098	0.256		
DSBP 15 +; FS$<$15 days	11	33	-0.047	0.272		
DSBP$<$15; No F.A.	12	400	-0.029	0.086		
DSBP 15+; No F.A.	13	102	-0.245	0.112		
(omitted: All DSFA 15+)		252				
Food Program Status:						2.85**
Huntingdon County:						
DSFS$_1$$<$ 15 days	16	24	-0.316	0.420		
No FS$_1$ or 15+ days	17	138	0.385	0.231		
DSFS$_2$$<$ 15 days	19	34	-0.152	0.421		
No FS$_2$ or 15+ days	20	94	0.433	0.222		
Bedford County:						
No CD	26	89	0.286	0.066		
No FS$_1$	27	112	0.195	0.061		
DSCD$<$ 15 days	28	66	0.363	0.285		
DSCD 15+ days	29	97	0.211	0.085		
DSFS$_1$$<$15 days	30	67	0.360	0.251		
DSFS$_1$ 15+ days	31	36	0.131	0.108		
DSFS$_2$$<$ 15 days	32	64	0.136	0.255		
(omitted No FS$_2$ Bedford)		157				
Income/Poverty Threshold:						1.51
In/Po 1-1.25	40	90	0.084	0.055	1.522	
In/Po 1.26+	41	147	0.055	0.051	1.090	
(omitted In/Po $<$1.0)		764				
Monthly Food Exp./Person	59	n	0.003	0.001	2.436*	
Income Frequency (1=once or less/mo.)	61	253	-0.069	0.043	1.601	

$R^2 = 0.134$ *$p < 0.05$

$F = 3.937$** **$p < 0.01$

Table B8. EQUATION 109; RIBOFLAVIN ADEQUACY RATIO AS DEPENDENT VARIABLE, (n=1001)

Variable	i Variable Number	n_i Cell Count	b_i Regression Coefficient	s_{b_i} Standard Error	Relevant Student t Values	F Ratio
Education of Homemaker (years):	3	n	-0.002	0.002	1.100	
Age of Homemaker (years):	6	n	-0.005	0.001	4.115**	
Home Produced Food (1=yes):	4	523	0.022	0.031	0.709	
(omitted: No HPF)		478				
Size of Household:						7.60**
Size 3 - 4	23	261	0.121	0.046		
Size 5 - 6	24	231	0.216	0.053		
Size 7 +	25	202	0.238	0.054		
(omitted: size< 3)		307				
Nutr. Aide Visits:[1]						
N.A.V. 3 - 5	37	37	0.452	0.192		
N.A.V. 6 -12	38	57	0.338	0.197		
N.A.V. 13-60	39	29	0.400	0.219		
(omitted: N.A.V.< 3)		878				
Interactions:						
N.A.V.< 3; HFS<15 days	33	32	0.462	0.341		
N.A.V. 3+; HFS<15 days	34	24	0.159	0.397		
N.A.V.< 3; no F.S. or >15 days	35	135	-0.130	0.218		
N.A.V. 3 no F.S. or >15 days	36	92	-0.433	0.290		
(omitted: HFS 15 + days)		718				
Unit Vector (constant)	21	n	1.025	0.128		
Weekdays	22	932	-0.173	0.059	2.924**	
(omitted: Sat. and Sun.)		69				

[1] These variables include observations in Huntingdon County only, since the Nutrition Education Program did not exist in Bedford County.

*$p < 0.05$
**$p < 0.01$

Table B8. (continued)

Variable	i Variable Number	n_i Cell Count	b_i Regression Coefficient	s Standard Error	Relevant Student t Values	F Ratio
Days Since Payday:						
DSBP 15 + days	14	198	0.155	0.088		
DSBP Not rep.	15	89	0.030	0.090		
(omitted: DSBP< 15 days)		714				
Interactions:						0.65
DSBP<15; CD<15 days	8	39	0.113	0.291		
DSBP 15 +; CD <15 days	9	24	-0.108	0.303		
DSBP<15; FS<15 days	10	151	0.029	0.247		
DSBP 15 +; FS <15 days	11	33	-0.005	0.262		
DSBP<15; No F.A.	12	400	0.008	0.083		
DSBP 15+; No F.A.	13	102	0.140	0.108		
(omitted: All DSFA 15+)		252				
Food Program Status:						4.28**
Huntingdon County:						
DSFS$_1$< 15 days	16	24	-0.397	0.405		
No FS$_1$ or 15+ days	17	138	0.393	0.223		
DSFS$_2$< 15 days	19	34	-0.284	0.406		
No FS$_2$ or 15+ days	20	94	0.476	0.214		
Bedford County:						
No CD	26	89	0.315	0.064		
No FS$_1$	27	112	0.251	0.059		
DSCD<15 days	28	66	0.212	0.275		
DSCD 15+ days	29	97	0.296	0.082		
DSFS$_1$< 15 days	30	67	0.302	0.242		
DSFS$_1$ 15+ days	31	36	0.274	0.104		
DSFS$_2$< 15 days	32	64	0.099	0.246		
(omitted No FS$_2$ Bedford)		157				
Income/Poverty Threshold:						2.09
In/Po 1-1.25	40	90	0.014	0.053	0.272	
In/Po 1.26+	41	147	0.100	0.049	2.041*	
(omitted In/Po< 1.0)		764				
Monthly Food Exp./Person	59	n	0.003	0.001	2.504*	
Income Frequency (1=once or less/mo.)	61	253	-0.120	0.041	2.895**	

R^2 = 0.224
F = 7.334*

*$p < 0.05$
**$p < 0.01$

Table B9. EQUATION 1.10; NIACIN ADEQUACY RATIO AS DEPENDENT VARIABLE (n=1001)

Variable	i Variable Number	n_i Cell Count	b_i Regression Coefficient	s_{b_i} Standard Error	Relevant Student t Values	F Ratio
Education of Homemaker (years):	3	n	0.002	0.002	0.923	
Age of Homemaker (years):	6	n	-0.002	0.001	1.807	
Home Produced Food: (1=yes):	4	523	0.046	0.033	1.389	
(omitted: No HPF)		478				
Size of Household:						1.04
Size 3 - 4	23	261	-0.074	0.049		
Size 5 - 6	24	231	-0.048	0.056		
Size 7 +	25	202	-0.088	0.057		
(omitted: size$<$ 3)		307				
Nutr. Aide Visits:[1/]						
N.A.V. 3 - 5	37	37	0.634	0.205		
N.A.V. 6 -12	38	57	0.350	0.210		
N.A.V. 13-60	39	29	0.358	0.234		
(omitted: N.A.V.$<$ 3)		878				
Interactions:						
N.A.V. 3; HFS$<$15 days	33	32	0.043	0.365		
N.A.V. 3+; HFS$<$15 days	34	24	-0.265	0.424		
N.A.V.$<$3; no F.S. or$>$15 days	35	135	-0.201	0.233		
N.A.V. 3+; no F.S. or$>$15 days	36	92	-0.642	0.309		
(omitted: HFS 15 + days)		718				
Unit Vector (constant)	21	n	1.138	0.137		
Weekdays	22	932	-0.164	0.063	2.594**	
(omitted: Sat. and Sun.)		69				

[1/] These variables include observations in Huntingdon County only, since the Nutrition Education Program did not exist in Bedford County.

*$p < 0.05$
**$p < 0.01$

Table B9. (continued)

Variable	i Variable Number	n_i Cell Count	b_i Regression Coefficient	s_{b_i} Standard Error	Relevant Student t Values	F Ratio
Days Since Payday:						
DSBP 15 + days	14	198	0.044	0.094		
DSBP Not rep.	15	89	-0.024	0.096		
(omitted: DSBP $<$ 15 days)		714				0.99
Interactions:						
DSBP $<$ 15; CD $<$ 15 days	8	39	-0.340	0.310		
DSBP 15 +; CD $<$ 15 days	9	24	-0.189	0.323		
DSBP $<$ 15; FS $<$ 15 days	10	151	0.013	0.264		
DSBP 15 +; FS $<$ 15 days	11	33	0.092	0.280		
DSBP $<$ 15; No F.A.	12	400	-0.120	0.088		
DSBP 15+; No F.A.	13	102	-0.172	0.116		
(omitted: All DSFA 15+)		252				
Food Program Status:						2.95**
Huntingdon County:						
DSFS$_1$ $<$ 15 days	16	24	0.019	0.433		
No FS$_1$ or 15+ days	17	138	0.497	0.238		
DSFS2 $<$ 15 days	19	34	0.085	0.433		
No FS$_2$ or 15+ days	20	94	0.647	0.228		
Bedford County:						
No CD	26	89	0.249	0.068		
No FS$_1$	27	112	0.189	0.063		
DSCD $<$ 15 days	28	66	0.408	0.294		
DSCD 15+ days	29	97	0.160	0.088		
DSFS$_1$ $<$ 15 days	30	67	0.179	0.259		
DSFS$_1$ 15+ days	31	36	0.096	0.111		
DSFS$_2$ $<$ 15 days	32	64	-0.038	0.263		
(omitted No FS$_2$ Bedford)		157				
Income/Poverty Threshold:						1.24
In/Po 1-1.25	40	90	0.022	0.057	0.383	
In/Po 1.26+	41	147	0.082	0.052	1.570	
(omitted In/Po $<$ 1.0)		764				
Monthly Food Exp./Person	59	n	0.004	0.001	3.173**	
Income Frequency (1=once or less/mo.)	61	253	-0.106	0.044	2.397*	

$R^2 = 0.121$ *$p < 0.05$
$F = 3.480$** **$p < 0.01$

Table B10. EQUATION 1.11; VITAMIN C ADEQUACY RATIO AS DEPENDENT VARIABLE, (N=1001)

Variable	i Variable Number	n_i Cell Count	b_i Regression Coefficient	s_{b_i} Standard Error	Relevant Student t Values	F Ratio
Education of Homemaker (years):	3	n	-0.003	0.002	1.242	
Age of Homemaker (years):	6	n	-0.000	0.002	0.240	
Home Produced Food: (1=yes):	4	523	0.175	0.044	3.984**	
(omitted: No HPF)		478				
Size of Household:						1.69
Size 3 - 4	23	261	0.081	0.065		
Size 5 - 6	24	231	0.163	0.075		
Size 7 +	25	202	0.133	0.076		
(omitted: size $<$3)		307				
Nutr. Aide Visits:1/						
N.A.V. 3 - 5	37	37	0.731	0.272		
N.A.V. 6 -12	38	57	0.336	0.278		
N.A.V. 13-60	39	29	0.319	0.310		
(omitted: N.A.V. $<$ 3)		878				
Interactions:						
N.A.V. $<$3; HFS $<$15 days	33	32	0.098	0.483		
N.A.V. 3+; HFS $<$ 15 days	34	24	-0.262	0.562		
N.A.V. $<$3; no F.S. or $\geq$ 15 days	35	135	-0.554	0.309		
N.A.V. 3+; no F.S. or $>$15 days	36	92	-0.886	0.410		
(omitted: HFS 15 + days)		718				
Unit Vector (constant)	21	n	0.489	0.181		
Weekdays	22	932	0.047	0.084	0.565	
(omitted: Sat. and Sun.)		69				

1/ These variables include observations in Huntingdon County only, since the Nutrition Education Program did not exist in Bedford County.

*$p < 0.05$
**$p \leq 0.01$

Table B10. (continued)

Variable	i Variable Number	n_i Cell Count	b_i Regression Coefficient	s_{b_i} Standard Error	Relevant Student t Values	F Ratio
Days Since Payday:						
DSBP 15 + days	14	198	0.258	0.125		
DSBP Not rep.	15	89	0.077	0.127		
(omitted: DSBP $<$ 15 days)		714				0.70
Interactions:						
DSBP < 15; CD < 15 days	8	39	-0.307	0.411		
DSBP 15 +; CD < 15 days	9	24	-0.515	0.428		
DSBP < 15; FS < 15 days	10	151	0.014	0.349		
DSBP 15 +; FS < 15 days	11	33	-0.162	0.371		
DSBP < 15; No F.A.	12	400	0.007	0.117		
DSBP 15+; No F.A.	13	102	-0.252	0.153		
(omitted: All DSFA 15+)		252				
Food Program Status:						3.08**
Huntingdon County:						
DSFS$_1$ < 15 days	16	24	0.133	0.573		
No FS$_1$ or 15+ days	17	138	0.994	0.316		
DSFS$_2$ < 15 days	19	34	0.076	0.574		
No FS$_2$ or 15+ days	20	94	0.889	0.303		
Bedford County:						
No CD	26	89	0.364	0.090		
No FS$_1$	27	112	0.258	0.083		
DSCD < 15 days	28	66	0.574	0.389		
DSCD 15+ days	29	97	0.201	0.116		
DSFS$_1$ < 15 days	30	67	0.320	0.342		
DSFS$_1$ 15+ days	31	36	0.104	0.147		
DSFS$_2$ < 15 days	32	64	-0.049	0.348		
(omitted: No FS$_2$ Bedford)		157				
Income/Poverty Threshold:						0.05
In/Po 1-1.25	40	90	0.024	0.075	0.322	
In/Po 1.26+	41	147	-0.001	0.069	0.009	
(omitted: In/Po < 1.0)		764				
Monthly Food Exp./Person	59	n	0.004	0.002	2.415	
Income Frequency (1=once or less/mo.)	61	253	-0.027	0.059	0.461	

$R^2 = 0.141$

$F = 4.168$

*$p < 0.05$

**$p < 0.01$

APPENDIX C

SAMPLING PROCEDURE

The sampling procedure, as described by Yoder [31], was designed to meet the analytical purposes of the study, while gathering as much information about the population as possible with the resources available to the survey. A 1967 survey revealed that roughly half of the low-income families in Bedford County are "empty nests," families containing no children under age 18. Most of the persons in empty nests are 65 years of age and over. There was reason to believe that in comparison with families having children, the empty nest families would exhibit a smaller variance in the attributes being investigated. This implies that the empty nest families could be sampled at a relatively lower rate to achieve the same degree of precision obtained from a larger sample of nonempty nest families. It was arbitrarily decided that in Bedford County seven out of every 10 empty nest families initially selected would be deleted from the sample; in Huntingdon County half the empty nests were deleted.[1]

Three sampling frames were used in drawing the sample: (1) the "CD List"--a list of all 698 families who were certified eligible to receive Commodity Distribution foods in Bedford County during June of 1969 and (2) the list of Nutrition Education program participants in Huntingdon County, and (3) the "1967 Survey List"--a list of more than 600 families interviewed in a 1967 survey conducted in these two counties for the Office of Economic Opportunity by the Department of Agricultural Economics and Rural Sociology. A systematic random sample was drawn from the "CD List." Families were selected at a rate of three in eight. Seven out of every 10 empty nests were then systematically deleted from the sample. A complete enumeration of the Nutrition Education families was attempted.

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[1] Each observation was assigned a weight based on the sampling rate. However, these weights were not considered in estimating the regression equations. Because of the nature of the regression model, a bias would have been introduced by using weighted regression techniques.

The "1967 Survey List" was used to obtain the third part of the sample, so as to provide a comparison group of families not receiving commodities. About three-fourths of the families contacted from this list in Bedford County during Wave I were not receiving CD. The sampling method used in the "1967 Survey" was essentially an area sampling method, with sample size proportionate to the number of low-income families in each of 84 census tracts, according to the 1960 Census. Starting at predetermined points in each selected tract, enumerators proceeded down a road in a systematic pattern, interviewing every family on both sides of the road, until a total of four low-income families had been enumerated in each tract. Areas in the county that had less than 25 percent of low-income families in 1960 were omitted from the sample. Thus, the sample is representative of the parts of the county having the highest incidence of poverty. This restriction was used to economize on the interviewers' time, by eliminating a large number of nonpoor families that would otherwise have to be contacted by the enumerators.

Initially, only 50 of the 84 tracts from the "1967 Survey" were to be included in the Bedford County sample, and every family on the list was contacted, whether or not they had been low-income in 1967. However, after three weeks of interviewing it became clear that two changes should be made in the sampling procedure: (1) It appeared that the number of low-income families obtained from only 50 of the 84 tracts would be too small, due to the unexpected number of deaths, outmigrations, and families rising above the poverty line. The remaining 34 tracts were then included in the sample. (2) Based on the first three weeks of interviewing, it was decided that for the sake of survey efficiency, the majority of the families who had not been low-income in the 1967 survey would not be interviewed. Only two of the first 76 such families had become low-income families by the summer of

1969. Thus, for the remainder of the survey, only the families that had been "near poor"--those no more than $500 above the poverty line in 1967--would be interviewed. In this category, only eight of 164 or 4.8 percent were below the poverty line in the summer of 1969.

Each sample tract encompassed a certain segment of road between the starting point and the point at which the fourth low-income family had been found in the 1967 survey. During the Wave I surveys in the summer of 1969, the enumerators attempted to contact all the families along the road between these two points, who had been interviewed in the 1967 Survey and who had been found to have incomes below the poverty line, or at most not more than $500 above the poverty line. In addition, enumerators also visited any families residing along this strip of road who had not been contacted in 1967 (including some families that had recently moved into the area).

In Bedford County 274 families were interviewed; 189 were interviewed in Huntingdon County. For the subsequent surveys (Waves II and III in Bedford, and Wave II in Huntingdon County) the enumerators attempted to contact each of these same families, regardless of their current income or program participation status. Families that had moved out of the county were deleted from the sample. Very few homemakers refused to be interviewed.